TERUFUSION®

SYRINGE PUMP

Model STC-523

Service Manual

TERUMO
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10. Reference Documents
10.1 IC Pinouts (Table of Contents)

µPD8749HC/D 10-
µPD82C43C/CY/D/G 10-
TD62501P, TD62502P, TD62503P, TD62504P,
TD62505P, TD62506P, TD62507P 10-
µPC177/339 10-
HD14013B 10-
HD14011B 10-
µPC1251/358 10-

10.2 Detection Element Features

SHS260 10
TLP907(LB) 10

1. OUTLINE

This service manual has been written for field maintenance of the STC-523 syringe pump.
In response to user claims, repairs should, in principle, be carried out using the following procedure:

(1) Before setting out for the user's premises to carry out repairs, carefully re-read both the Instruction Manual and this Service Manual.

(2) Check that the conditions of use are as indicated in the Instruction Manual.

(3) If the failure is a result of incorrect usage, correct the cause of the failure, then give the user instructions on the correct use of the equipment.

(4) Double-check the claim before starting repairs, and only start the repairs after you have fully understood the nature of the problem.

(5) If the equipment fails to perform correctly even when used properly, carry out the troubleshooting procedures described in this Service Manual.

(6) If you are not able to repair the equipment using the procedures contained in this manual, it will have to be repaired at the factory. Clearly indicate the nature of the problem and the repairs required and forward the equipment to the factory.

(7) If possible, sterilize any exchange parts that are being returned to the factory or those that have come into contact with patients' body fluids, etc. If this is not possible and the parts are returned without being sterilized, they must be hermetically sealed and a warning included in the returned package.

Cautions

(1) Do not attempt to disconnect or connect connectors or PCBs with the equipment's power supply turned ON.

(2) Before starting, visually check the equipment for disconnected wires, shorting, unplugged connectors and faulty or damaged parts, listen for abnormal sounds, and make sure there are no strange smells (burning resistors, etc.).

(3) On completion of the inspection and repairs, make sure that all the switches are set to their correct positions, clean the equipment and its surroundings, then notify the person responsible of the repairs you have made.

(4) When handling semiconductors (specially MOS ICs), take care to prevent damage by static, etc.
  - Ground your body and soldering irons, etc., via a 1MΩ resistor (this does not apply to insulated soldering irons, but you must check the insulation).
  - When transporting ICs and PCBs, place them in conductive containers or wrap them in conductive sheeting (aluminum foil, etc.). (Avoid the use of plastics such as vinyl and styrofoam pads.)
  - Do not subject ICs and PCBs to shock or excessive pressure.

(5) If replacing a PCB cures a fault, replace the original PCB to check that the original fault occurs again. If not, it is likely that the contacts were faulty, and you should thoroughly investigate this possibility.

2. SPECIFICATIONS

Name:	Terufusion Syringe Pump	
Model:	STC-523	
Product Code:	ME-STC523	
Syringes Used:	Terumo 20ml, 30ml, and 50ml syringes	
Filling Range:	0.1-150.0ml/h (0.1ml/h steps)	
Precision:	within ±1% (±3% including syringe)	
Cover detection pressure:	Greater than 0.7kg/cm2	
Fast feed:	Approx 400ml/h (20ml syringe, normal power supply)	
	Approx 500ml/h (30ml syringe, normal power supply)	
	Approx 800ml/h (50ml syringe, normal power supply)	
Alarms:	Residual amount, overload, battery (visual and audial alarms, and buzzer switch provided)	
Operating conditions:	Ambient temperature:	10-40°C
	Relative humidity:	30-85% (no condensation)
	Air pressure:	700-1060 millibars
Idle conditions:	Ambient temperature:	-20-45°C
	Relative humidity:	10-95% (according to packaging)
	Air pressure:	500-1060 millibars
Storage conditions:	Ambient temperature:	-20-45°C
	Relative humidity:	10-95% (no condensation)
	Air pressure:	500-1060 millibars
Power supply:	90 to 132/180 to 264VAC±10% About 2 hours on internal battery (after 15-hour charge)	
Maximum consumption:	15VA Internal battery gives 2 hours of continuous use (after 15-hour charge)	
Shock prevention:	Class II	CF type
External dimensions:	300mm (w) x 128mm (h) x 139mm (d)	
Weight:	2kg	
Accessories:	Pole clamp	(x1)
	AC power source cable	(x1)
	Instruction Manual	(x1)

* Specifications and appearance subject to change without notice.

3. REQUIRED TOOLS AND INSTRUMENTS

(1) Digital voltmeter	Voltage range 10V, resistance range 1Ω
(2) Synchroscope	Frequency range 500KHz
(3) Adjustable power supply	Voltage 0-15V
(4) Frequency counter	Frequency range 10KHz
(5) Pressure meter	Pressure range 0-3.0kg/cm^2
(6) New Terumo syringes	20ml, 30ml and 50ml
(7) Standard tool kit	
(8) Special tool kit	• for removing M16 tube nuts • for removing seal nuts

4. OPERATING PRINCIPLE

The STC-523 motor control unit consists of a reference signal circuit, comparator control circuit, drive circuit and rpm-detection circuit.

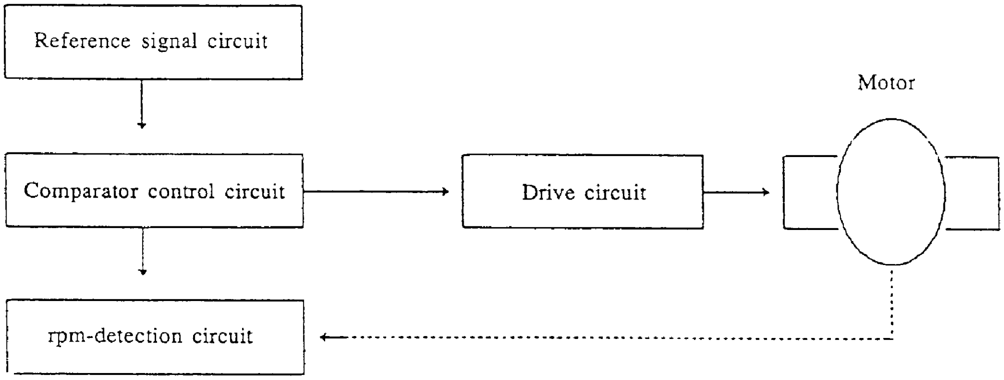

Reference signal circuit
Motor
Comparator control circuit
Drive circuit
rpm-detection circuit

Figure 4.1 Basic Block Diagram

The motor turns in response to the signals from the drive circuit, but is not stabilized in relation to load fluctuations. The rpm-detection circuit, reference signal circuit and comparator circuit are therefore included to reduce this instability. The rpm are compared with the reference signals and the motor speed decreased if it is too fast and vice versa.
The reference signals are determined from the type of syringe and the set amount by which it is to be filled. The reference signal circuit and comparator control circuit consists of single-chip processors; the rpm-detection unit consists of two encoders that are connected directly to the motor shaft.

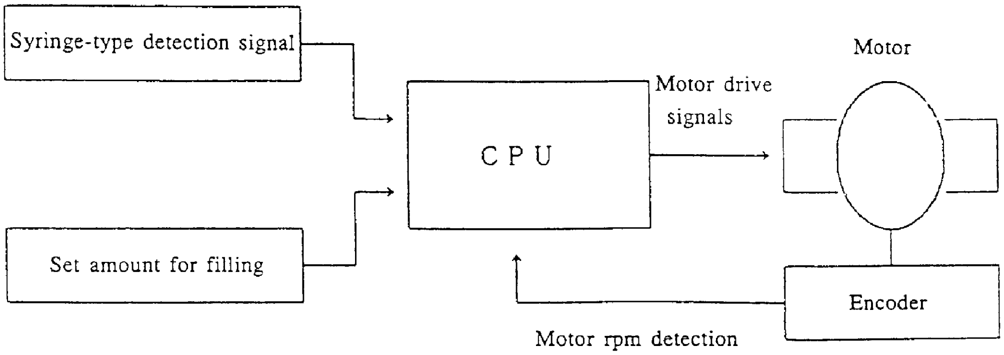

Syringe-type detection signal
Motor
Motor drive
signals
C P U
Set amount for filling
Encoder
Motor rpm detection

Figure 4.2 Simple Block Diagram of Motor Drive Unit

4.1 Electrical System

4.1.1 Electrical Structure

Name	Model	Functional Outline
Power supply unit	STC-523-1A11 board STC-523-1A01 circuit	• 10V (V2) and 5V (V1) voltage regulator • Battery charging • Power lamp • Generation of voltage drop signale
Control unit	STC-523-1A11 board	• CPU (Central Processing Unit) • Motor drive • Display drive • Over-discharge prevention
Logic unit	STC-503-1A32 (HIC)	• Motor control • Buzzer oscillation • Failsafe • rpm detection • Frequency division
Panel keyboard	STC-523-1F02 STC-523-1F01 circuit	• Keying-in unit
Overload detection unit	STC-523-1B11 board STC-523-1B01 circuit	• Photointerrupter for overload detectio
Residue detection unit	STC-523-1C11 board STC-523-1C01 circuit	• Photointerrupter for detecting residual amount
Syringe detection unit	STC-523-1D11 board STC-523-1D01 circuit	• Magnetic element
rpm-detection unit	STC-523-1E11 board STC-523-1E01 circuit	• Photointerrupter for detecting rpm

Figure 4.3 is an electrical block diagram.

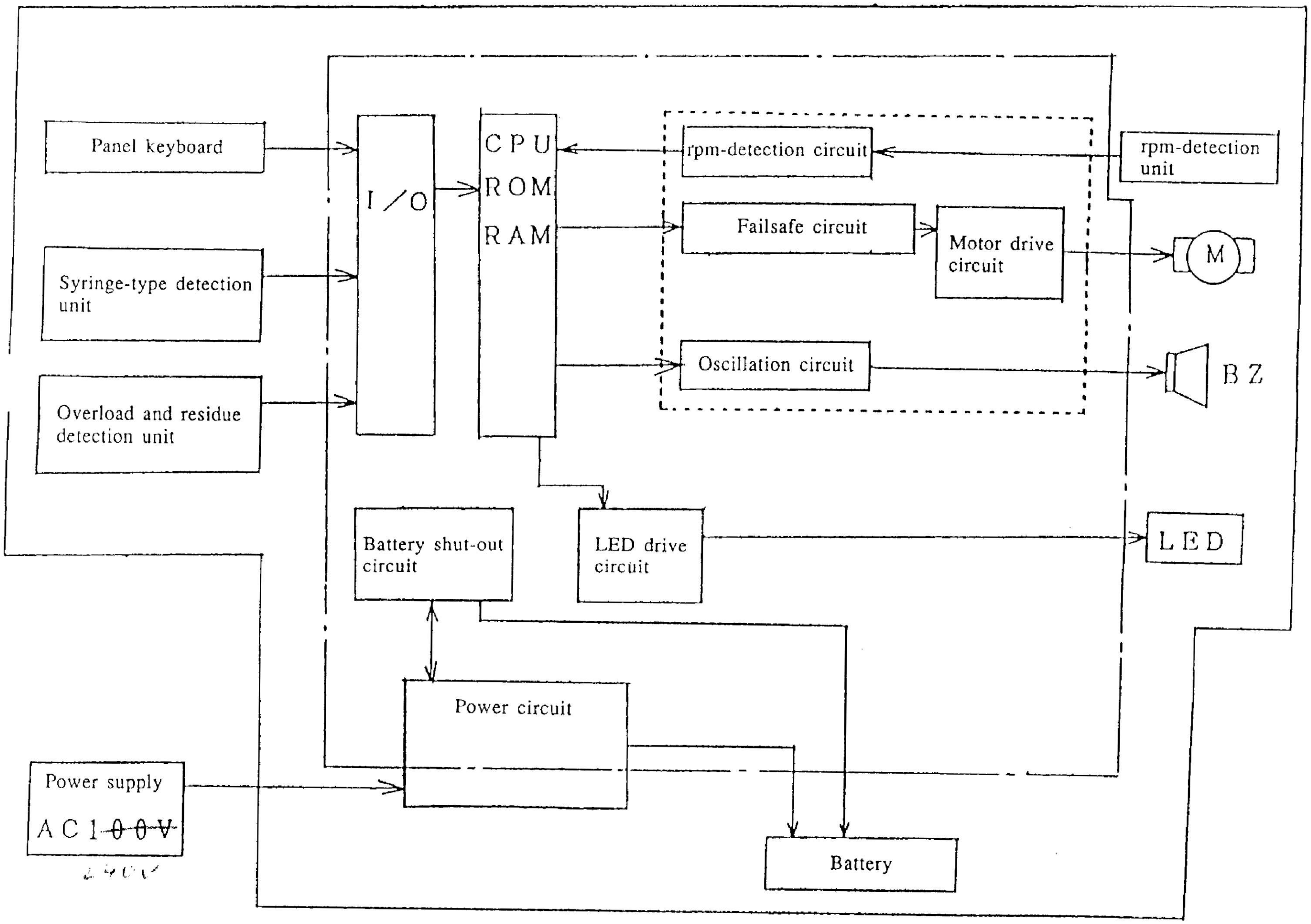

Panel keyboard
Syringe-type detection unit
Overload and residue detection unit
I/O
CPU
ROM
RAM
rpm-detection circuit
rpm-detection unit
Failsafe circuit
Motor drive circuit
M
Oscillation circuit
BZ
Battery shut-out circuit
LED drive circuit
LED
Power circuit
Power supply
AC1~~00V~~
240V
Battery

Figure 4.3 Block Diagram

4.1.2 How The Electrical System Functions

(1) Power Circuit (Control Board)

The power circuit is broadly divided into the 12V power regulator unit, 5V power regulator ur battery voltage-drop sensor, and POWER LED display circuit.

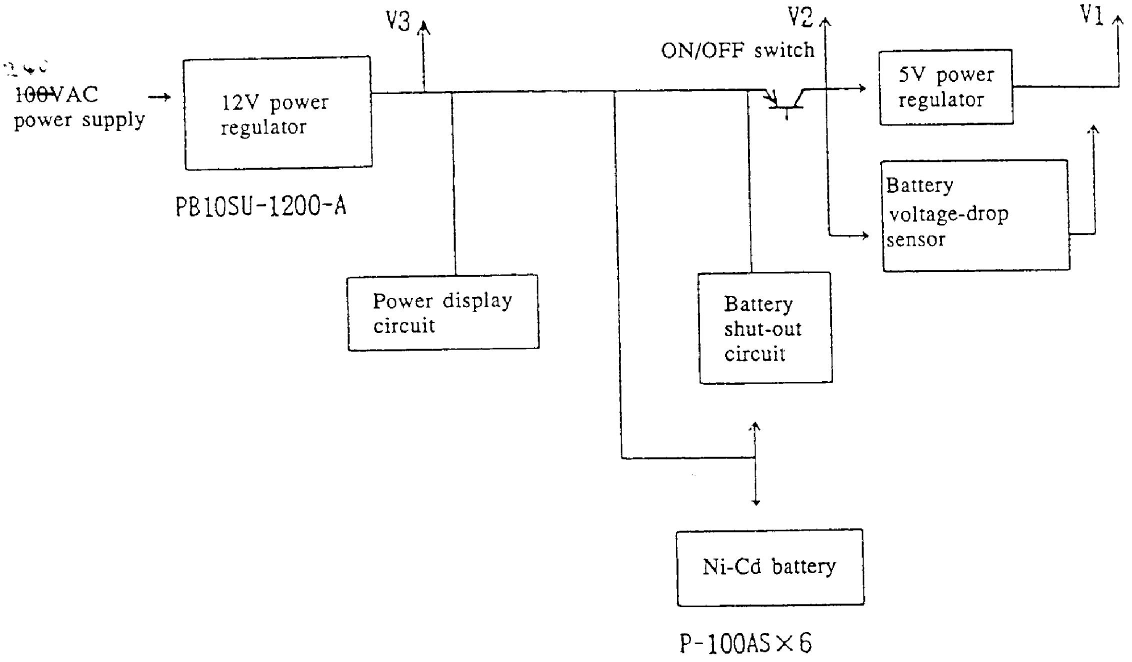

V3
V2
V1
ON/OFF switch
240
~~100~~VAC
power supply
12V power regulator
PB10SU-1200-A
5V power regulator
Battery voltage-drop sensor
Power display circuit
Battery shut-out circuit
Ni-Cd battery
P-100AS×6

Figure 4.4 Block Diagram of Power Supply

1) 12V Power Regulator

A constant 12V supply is created from the power supply and used for battery charging, fo 5V power regulator, the POWER LED, and motor. The voltage level is 12V between pi and 8 of connector 7.

2) 5V Power Regulator

Constant voltage V1 (5V) is created from V2 and supplied to those circuits (mainly the circuit) not supplied by V2 and V3.

3) Battery Voltage-Drop Sensor Comparator Unit

There are two comparators. One is used to issue an alarm if the battery voltage level drops, and the other is used to shut off the battery. The signal level at pin 1 of IC6 changes from HIGH to LOW when the output from the battery voltage-drop alarm comparator is 6.5±0.1V (see Figure 4.5). With the battery shut-out comparator, the signal level at pin 2 of IC6 changes from LOW to HIGH when the battery voltage is about 6V. Figure 4.6 is a diagram of the battery shut-out circuit.

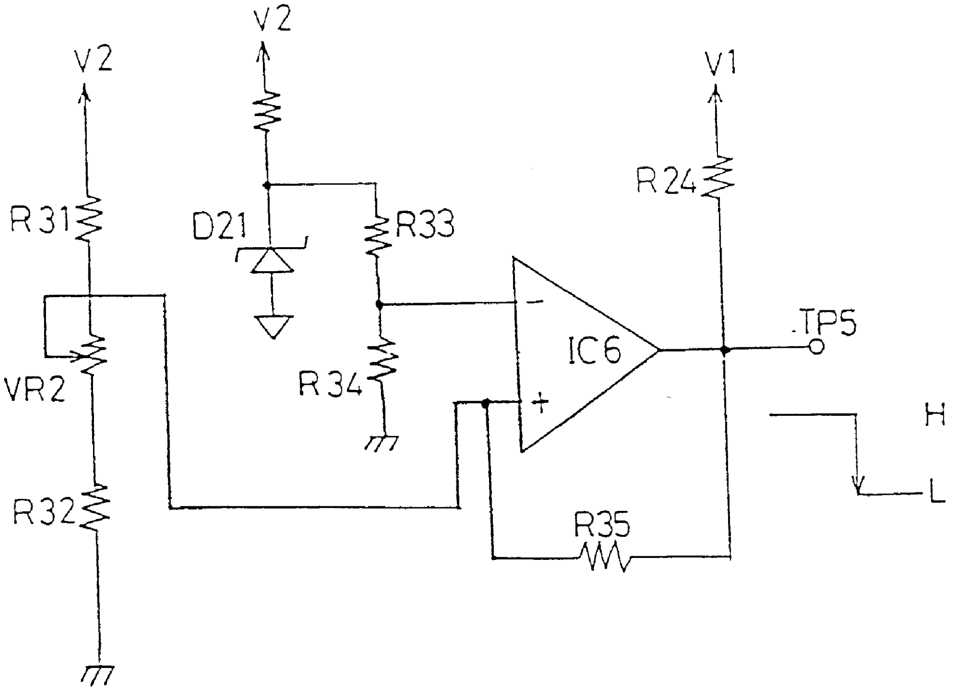
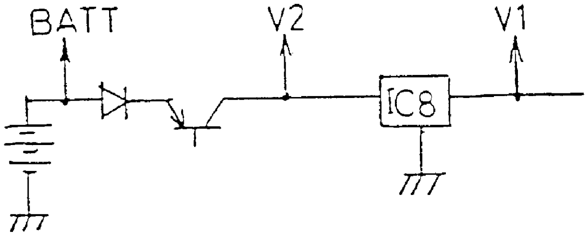


Figure 4.5 Battery Voltage-Drop Alarm Comparator Circuit


BATT
V2
V1
IC8

Circuit Diagram of Power Circuit

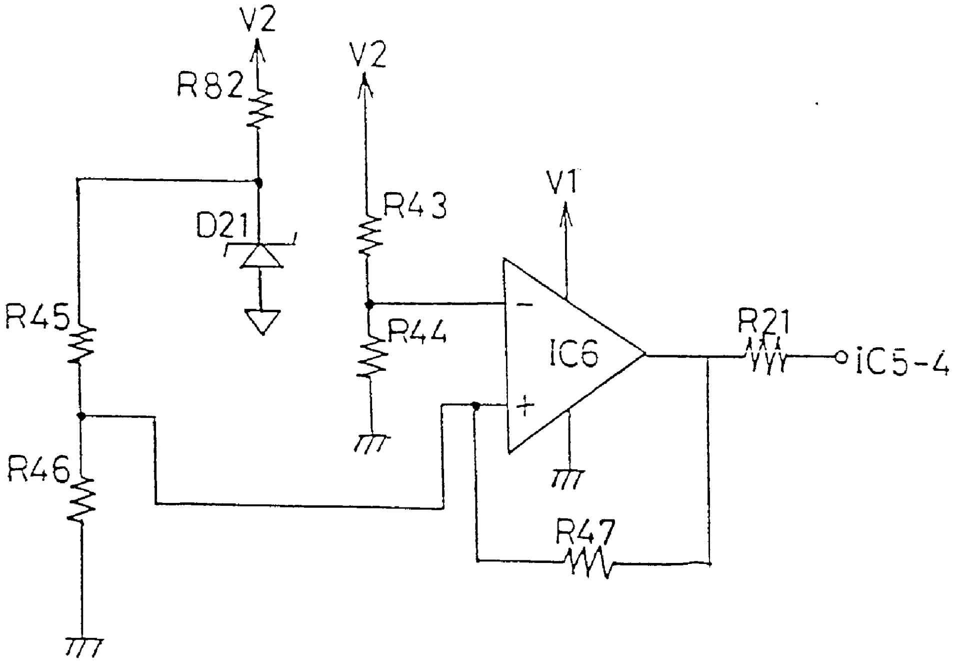
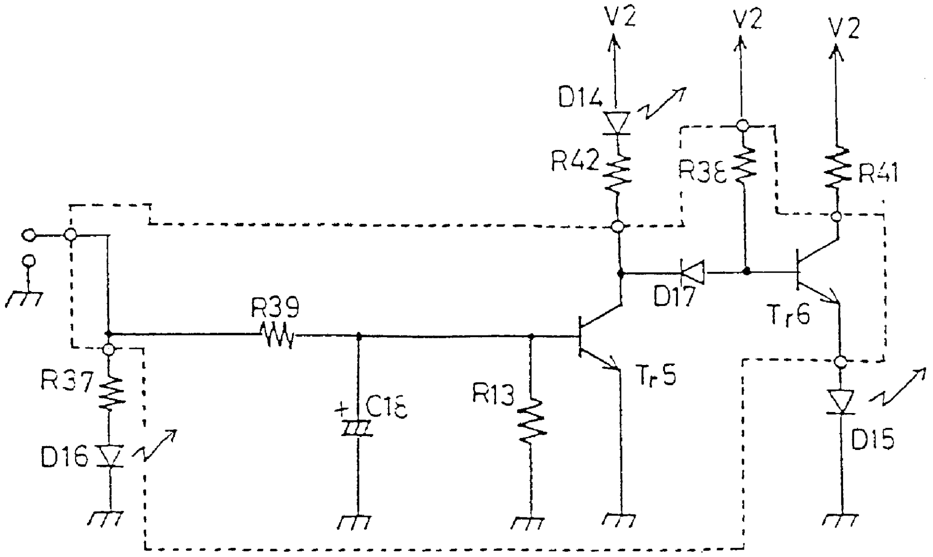

V2
R82
V2
D21
R43
V1
R45
R44
IC6
R21
IC5-4
R46
R47

Figure 4.6 Diagram of Battery Shut-Out Circuit

4) Power Supply LED Drive Circuit

This circuit is used to drive the CHARGE, BATTERY and POWER LEDs. The CHARGE LED lights when the equipment is connected to the AC power supply whether or not the pump is turned ON. Connecting an AC power supply causes a current to flow at R37 and D16 and the CHARGE LED (D16) to light. The current also flows at R39 and R40, a voltage of about 0.7V being applied to the base of Tr5. When the power switch is turned ON, a current flows at the POWER LED (D14), R42, and Tr5, causing the POWER LED to light. When Tr5 turns ON, Tr6 turns OFF and the BATTERY LED (D15) will not light. If the AC cord is then pulled out, no current flows from R37 and the CHARGE LED turns OFF, Tr5 turns OFF, and the POWER LED turns OFF. The voltage at the base of Tr6 changes from about 0.7V to 2.6V and Tr6 turns ON. When Tr6 turns ON, a current flows from V2 to R41, Tr6, and D15 and the BATTERY LED lights (see Figure 4.7).



STC-523-1A11 board

Figure 4.7 Power LED Drive Circuit

(2) Control Unit

The control unit is broadly divided into CPU, motor drive unit, LED drive unit, and battery shut-out unit.

1) CPU (ICs 1 and 2) (See Section 10 for details of ICs 1 and 2)

		Pin	Function
1)	IC1	P10~P13	Output LED scanning signals
2)	IC1	P20~P23	For connecting additional IO ports (IC2)
3)	IC1	DB0~DB7	Output LED data signals
4)	IC1	INT	Input interrupt signal
5)	IC1	P6	Output interrupt control signal
6)	IC1	P17	Output failsafe signal
7)	IC1	ALE	Output interrupt clock pulse (400Hz)
8)	IC1	P15	Output buzzer drive signal
9)	IC1	P14	Output motor drive signal
10)	IC1	T1	Input rpm detection signal
11)	IC2	P40, P41	Input syringe type detection signal
12)	IC2	P50	Input battery voltage-drop signal
13)	IC2	P51	Input residue detection signal
14)	IC2	P52	Input overload detection signal
15)	IC2	P60~P62	Output panel keyboard scan signals
16)	IC2	P70~P73	Input panel keyboard data signals

Note: IC1: 8-bit single chip processor
IC2: extended IO ports
P**: ports ** ("pin **" indicates IC legs, etc.)

2) Motor Drive Unit

The motor drive signals from the CPU pass via the logic unit (pin 15) and R76 and are applied to the base of Tr1. Tr2 and R77 control the motor current, preventing a current of greater than 150mA from reaching the motor.
D27 prevents a reverse voltage from the motor from reaching the power supply (see Figure 4.8).

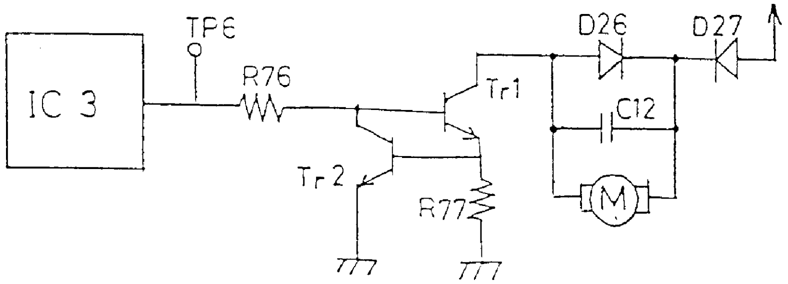


Figure 4.8 Motor Drive Circuit

3) LED Drive Unit

The LEDs are lit dynamically. Except for the POWER (D14), BATTERY (D15) and CHARGE (D16) LEDs, the LEDs are grouped into four and light in sequence every 2.5msec.

The four groups are as follows:

(1) D1, D8, D9, D10, D11, D12, D13
(2) D2, D7
(3) D3, D6
(4) D4, D5

- D1: 100s, D2: 10s, D3: 1s, D4: 1/10ths (flowrate)
- D5: BATTERY alarm, D6: RESIDUE alarm, D7: OVERLOAD alarm
- D8: STOP, D9: START, D10: FAST
- D11: [50], D12: [30], D13: [20] (Syringe type)

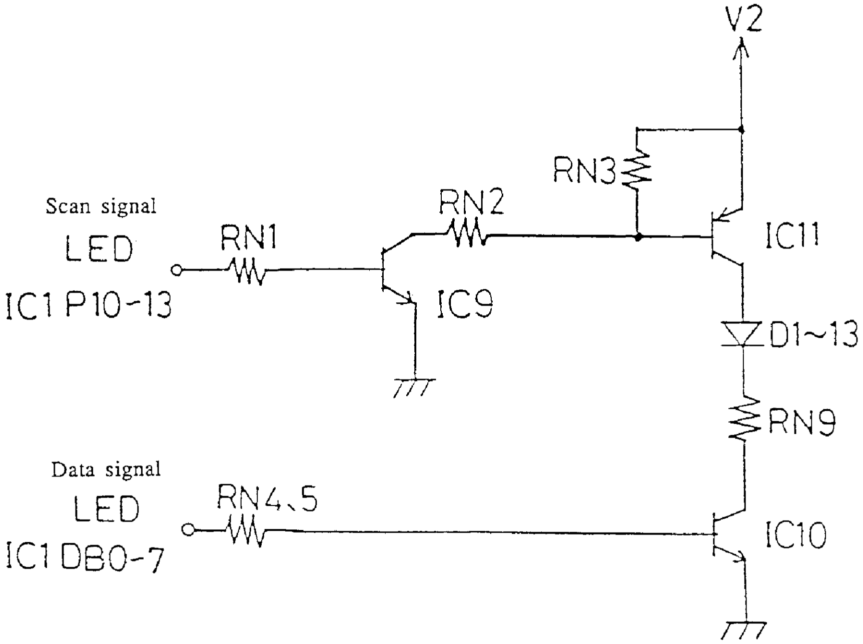

V2
RN3
RN2
Scan signal
LED
IC1 P10-13
RN1
IC9
IC11
D1~13
RN9
Data signal
LED
IC1 DB0-7
RN4、5
IC10

Figure 4.9 LED Drive Circuit

(3) Logic Unit

The logic unit is divided into the failsafe circuit, motor control circuit, buzzer oscillation circuit, rpm-detection circuit and frequency dividing circuit.

1) Failsafe Circuit

If, for any reason, CPU functions are disrupted, there is a risk of the motor running at full speed. The failsafe circuit is designed to immediately force the motor to stop under such circumstances and to simultaneously sound the buzzer to warn the operator of the situation.

When the CPU is functioning normally, the failsafe signal is output as a rectangular wave (a) about every 9.6msec. This signal is delayed at C2 to obtain signal d. Signal d and the input signal pass through a NAND gate to provide a large duty cycle signal (e). Because of C3's capacity, signal e changes to LOW before the signal reaches the threshold level and the load at C3 passes via R3 and is rapidly charged; the signal at f does not reach the threshold level (*) and the output signal g in the failsafe circuit is fixed HIGH. If the CPU is out of control, the failsafe signal is fixed either LOW or HIGH and the output signal g is fixed LOW.

* Threshold level

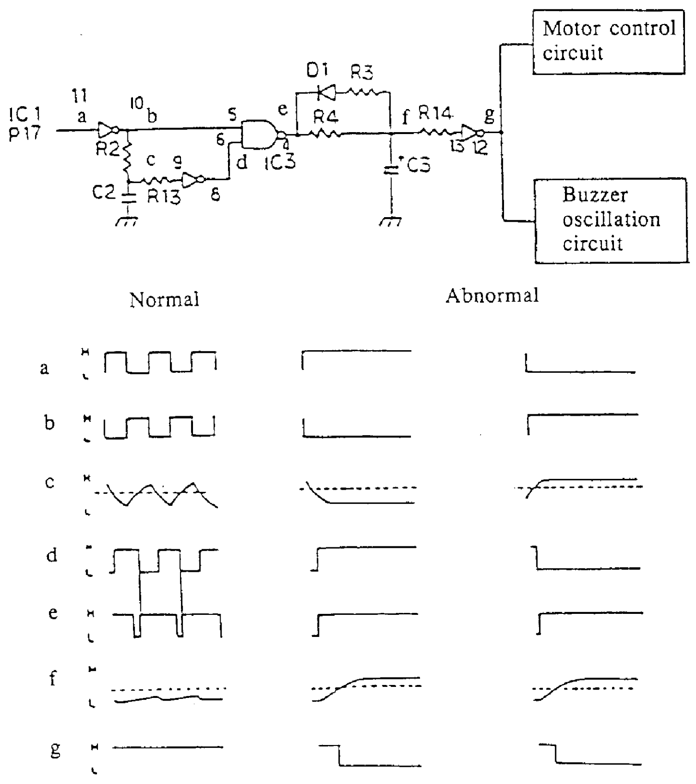

IC1
P17
11
a
10
b
R2
c
9
C2
R13
8
5
6
d
IC3
e
D1
R3
R4
f
R14
C3
13
12
g
Motor control circuit
Buzzer oscillation circuit
Normal
Abnormal
a
b
c
d
e
f
g
H
L

Figure 4.10 Failsafe Circuit and its Waveforms

5. ADJUSTMENT AND ASSEMBLY

The following procedure should be used to replace the control board (STC-523-1A11) or to disassemble and replace the drive unit, syringe-detection unit, clamp or overload-detection unit.
See the exploded diagrams in 9.3 and 9.6 for parts with numbers (9. -) after the part name. For example, see #8 in exploded diagram 9.3 for the control board (9.3 8).

5.1 Adjusting the Control Board (STC-523-1A11)

Measuring instruments and other tools

- Digital voltmeter: Voltage range 10V, resistance range 1Ω
- Adjustable power supply:Voltage 0-15V
- Frequency counter: Frequency range 10KHz

5.1.1 Adjusting The Battery Voltage-Drop Alarm (VR2)

Disconnect connector 7 from the control board (9.3 8), then connect the plus (+) side of the adjustable power supply to pin 1 and the minus (–) side to pin 3. Set the voltage to 6.5V, then adjust variable resistor VR2 until the BATTERY alarm lights.

Connect leads to the 8-pin connector as shown in the diagram below and fit a switch between pins 4 and 5 in place of the power switch.

* Check that the alarm is issued at a voltage of 6.5±0.1V. The voltage at TP5 changes from HIGH to LOW.

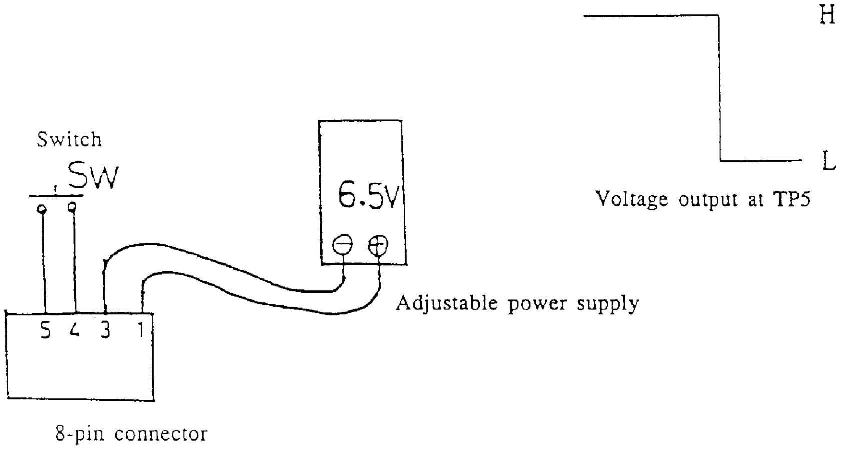
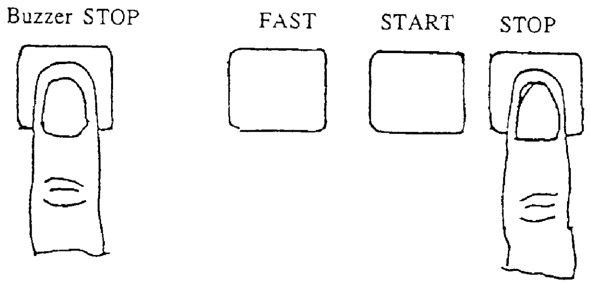


Figure 5.1 Connecting the Adjustable Power Supply

VR9 – volume
[illegible]

5.1.2 Adjusting the Buzzer Frequency (VR1)

Use the panel keyboard (9.3-2) to set the buzzer volume to maximum.



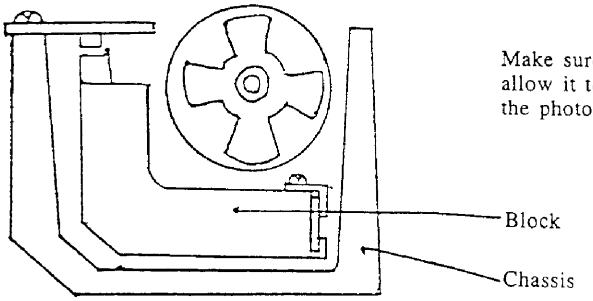
* If no alarm is being sounded, press and hold the STOP switch while switching the Buzzer STOP switch ON and OFF until the overload alarm can be heard.

→ High → Normal → Low → Off ─┐ (returns to High)

Connect the plus (+) side of the frequency counter to TP17 and the minus (–) side to TP1 or TP11, then adjust variable resistor VR1 to achieve a frequency of 270±10μs.

5.1.3 Adjusting the Residue-Detection Alarm

(1) Make sure that the residue-detection photointerrupter does not come into contact with the block when the slider is moved.



Make sure that block play does not allow it to come into contact with the photo interruptor.

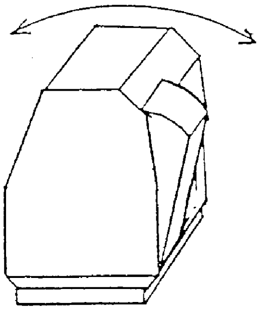
(2) Adjust the comparator voltages using variable resistor VR8 on the control board.

Connect the plus (+) side of the oscilloscope to pin 9 of IC6 and the minus (–) side to TP11 of TP1.

Adjust VR8 so that the voltage at pin 9 of IC6 is 2V.

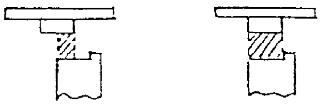
(3) Turn variable resistor VR7 clockwise.

Connect the plus (+) side of the oscilloscope to pin 8 of IC6.
Check that the voltage at pin 8 of IC6 does not drop below 2V when the slider is moved in the direction of the arrows when the residue alarm is being issued.



(4) If the residue alarm stops:

1. Correct the position of the board so that the reflective label that is stuck to the block squarely faces the residue detection element.

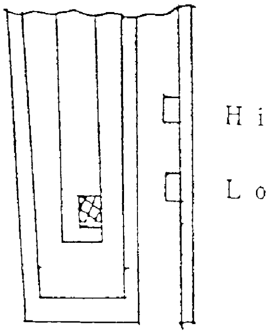


2. Variable resistor VR7 is used to adjust the sensitivity of the photointerruptor.
   Check the conditions in step (3) while rotating VR7 counterclockwise. Note that over-adjusting VR7 will result in reflected light from the area of the clutch spring retainer (9.6-27) triggering the photointerruptor, and this should be checked after adjustment.

5.1.4 Adjusting Syringe Detection

Connect the plus (+) side of the oscilloscope to pin 2 (Hi side) or pin 6 (Lo side) of IC7 and the minus (–) side to TP1 or TP11.

(1) Set the reference voltages using variable resistors VR3 and VR4.
Have ready 20ml, 30ml and 50ml syringes, then carry out the adjustments so that the LEDs light correctly for each size of syringe.
Set the Hi reference voltage using VR3 and the Lo reference voltage using VR4.

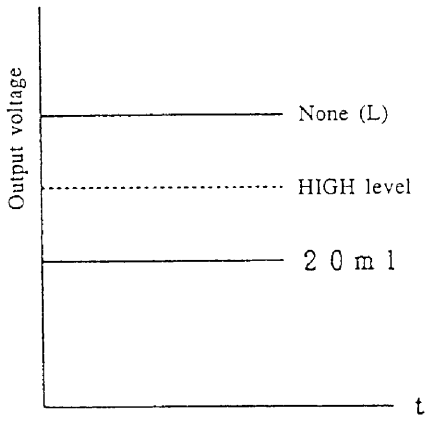


Syringe	Magnetic elements	
	M1	M2
None (L)	L	L
20	H	L
30	H	H
50	L	H
None (H)	L	L

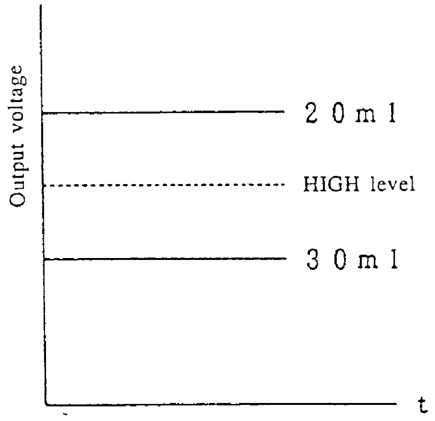
* Set the Hi reference voltage using VR3 and the Lo refer-

(2) Set the reference voltages as follows:
VR4: Lo voltage to HIGH between "None (L)" and "20ml".
VR3: Hi voltage to HIGH between "20ml" and "30ml".
* Check using the oscilloscope.

Lo


Output voltage
None (L)
HIGH level
20ml
t

Hi


Output voltage
20ml
HIGH level
30ml
t

The dotted line shows the reference voltage. Set the reference voltage to the mid point.

5.1.5 Adjusting Overload Detection

Overload detection is adjusted using variable resistors VR5 and VR6. Connect the minus (–) side c the oscilloscope to TP1 or TP11.

(1) Set the comparator level using VR5. Connect the plus (+) side of the oscilloscope to pin 10 c IC6 and adjust VR5 to achieve 1V.

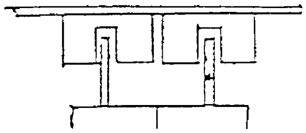
(2) See section 5.2.4 for how to adjust overload detection.
* Variable resistor VR6 is provided for adjusting sensitivity. See section 5.2.4 for details.

5.2 Disassembling and Replacing the Drive Unit

5.2.1 Fixing and Checking the Boards

(1) Location of Rotation-Detection Board (9.6-16)

Mount the rotation-detection board so that the photointerruptors do not come into contact with the motor (9.6-10) encoders (9.6-9).



* Make sure that you cannot hear them coming into contact with each other when the motor is ON.

Also try rotating the encoders to check that they are not coming into contact with the photointerruptors.

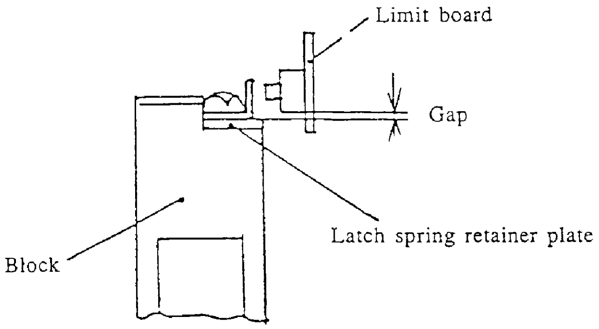
(2) Location of Residue-Detection Board (9.6-40)

Mount the residue-detection board so that the photointerruptors do not come into contact with the block (see section 5.1.3(1)).

Screw the residue-detection board to the chassis so that the alarm is issued at a residual amount of 2.5ml±0.9ml when using a 50ml syringe.

(3) Location of Limit Switch Board (9.6-37)

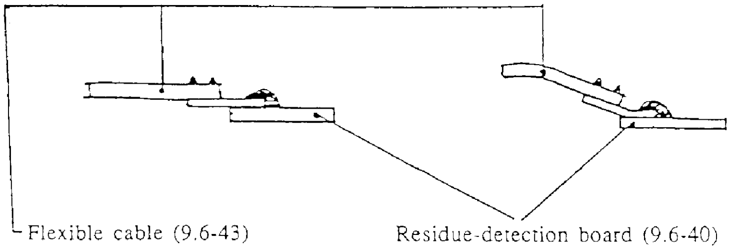
Mount the limit switch board so that the switch does not come into contact with the clutch spring retainer (the feed screw is to engage with the feed nut).



(4) Fixing the Flexible Cable

The flexible cable comes into contact with the chassis and bottom case. It must not make any noise when the slider is moved.

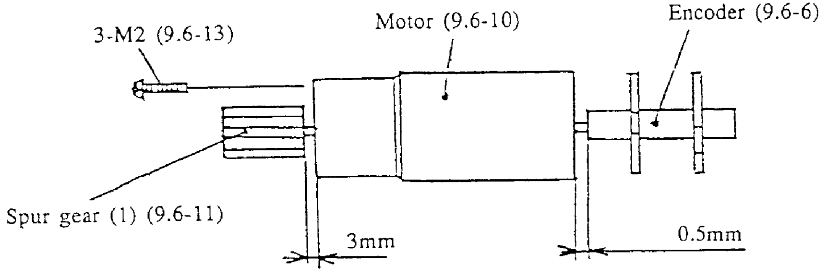
1) Change the position of the relay board (9.6-44), which is screwed to the block, and position the flexible cable so that it does not touch the chassis.
2) Slightly bend up the part which is soldered to the residue-detection board.



5.2.2 Speed-Reduction Unit Assembly

(1) Mounting the motor

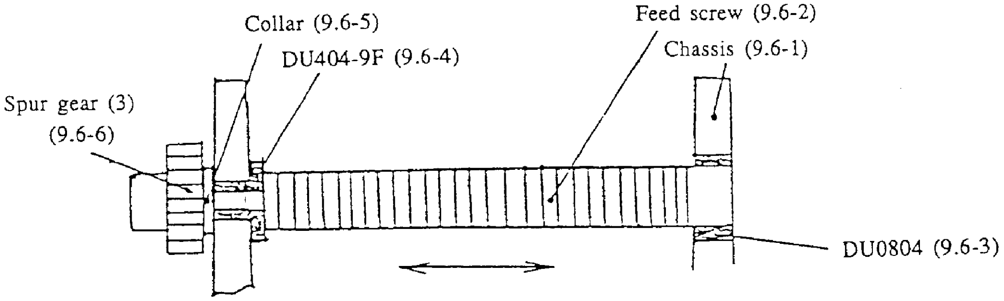
Mounting the spur gear (1)


3-M2 (9.6-13)
Motor (9.6-10)
Encoder (9.6-6)
Spur gear (1) (9.6-11)
3mm
0.5mm

When mounting the assembly on the chassis, make sure the motor cable projects upward.

* Gap (#3 in the figure) ensures that the spur gear does not come into contact with the moto

(2) Fixing the feed screw and spur gear (3)


Collar (9.6-5)
DU404-9F (9.6-4)
Feed screw (9.6-2)
Chassis (9.6-1)
Spur gear (3)
(9.6-6)
DU0804 (9.6-3)

Make sure to leave a play of about 0.2mm in the direction shown by the arrows.

Adjust the position so that the spur gear (3) does not come into contact with the chassis and ma it difficult to move.

* The feed screw is prevented from falling out by the spur gear (3) (fixed at one end)

* Do not apply excessive pressure to the feed screw when fitting it through the DU bushes

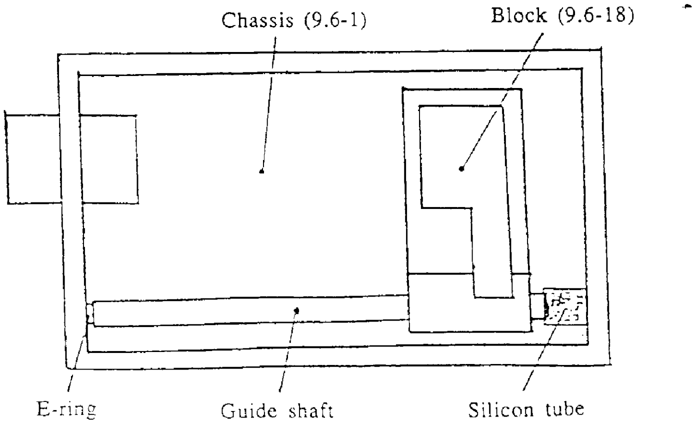
(3) Mounting the spur gear (2) (See exploded diagram 9.6)

Since spur gear (1) is screwed to the motor, gently rotate spur gear (3) so that the gear teeth aligned, fit spur gear (2), then fit the E-ring.

(4) Fix the guide shaft in position.

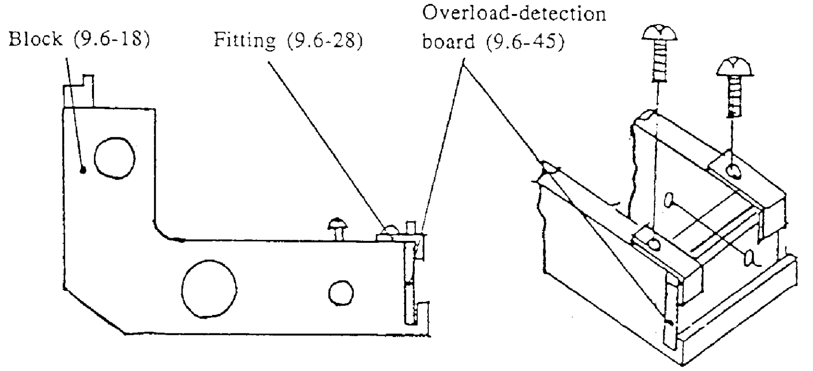
Insert the silicon tube as shown in the figure, then fit the E ring to fix the guide shaft in positi

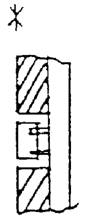
Insert the silicon tube as shown in the figure, then fit the E ring to fix the guide shaft in position.


Chassis (9.6-1)
Block (9.6-18)
E-ring
Guide shaft
Silicon tube

5.2.3 Block Assembly

(1) Fix the overload-detection board in position with the fittings.

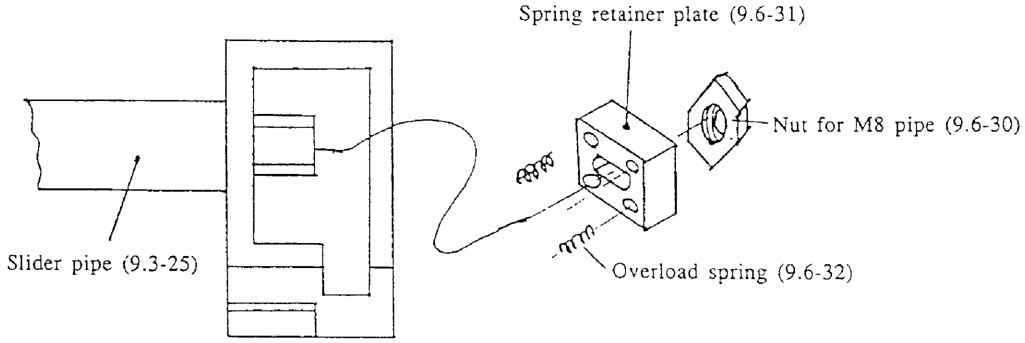

Block (9.6-18)
Fitting (9.6-28)
Overload-detection board (9.6-45)



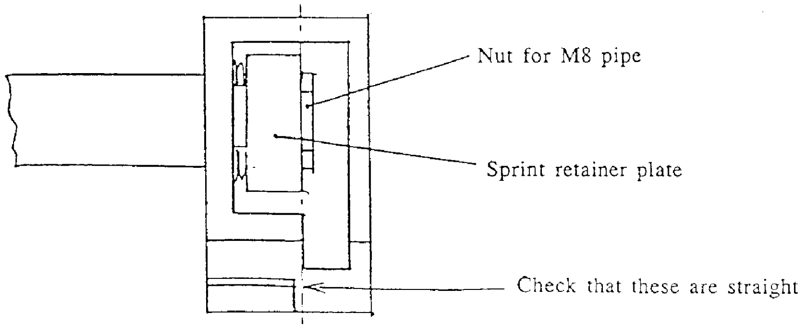
Section a-a

Semi tighten the overload-detection board in position.
Screw down the relay board (9.6-44) (See exploded diagram 9.6.)
* Check that the photointerruptor on the overload-detection board is facing the right way.

(2) Insert the block into the chassis, then assemble the overload-detection unit.


Spring retainer plate (9.6-31)
Nut for M8 pipe (9.6-30)
Slider pipe (9.3-25)
Overload spring (9.6-32)

Insert the slider pipe, then fix the block in position.


Nut for M8 pipe
Sprint retainer plate
Check that these are straight

Tighten the nut on the M8 pipe so that the spring retainer plate is positioned in the block as shown in the above figure.

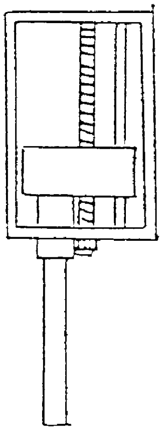
(3) Mount the feed screw and guide shaft.

See the section on assembling the speed reduction unit for details of the feed screw and guide shaft.

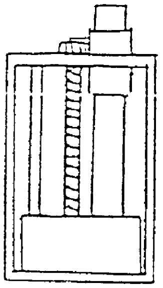
* Check that the drive unit functions smoothly.

To check that it moves smoothly through the full range, move the drive unit as shown below. If the slide pipe is as shown in ①, turning it up the other way should cause it to be as shown in ②. Conversely, if the slide pipe is as shown in ②, turning it up the other way should cause it to be as shown in ①.

①



②



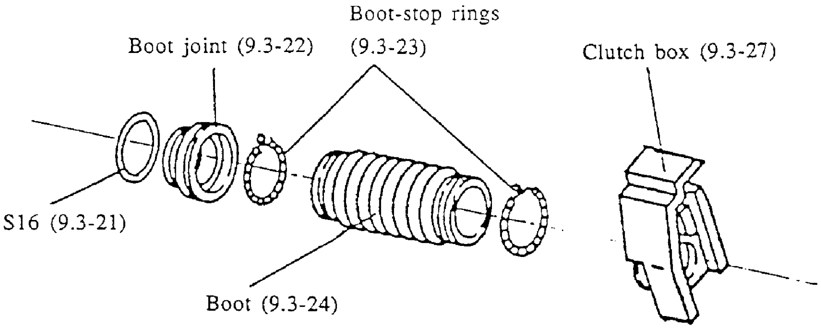
(4) Insert the feed nut into the block to mount the clutch spring (9.6-23).

5.2.4 Slider Unit Assembly

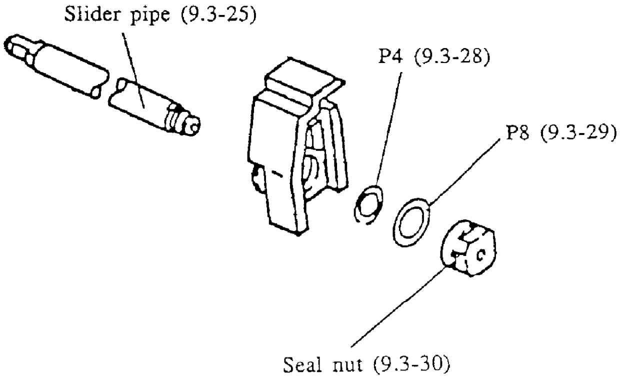
(1) Assemble the chassis and upper case.

* Make sure that the M16 pipe nut is on the slider pipe.

(2) Assemble the clutch box, boot, and boot joints.


Boot-stop rings (9.3-23)
Boot joint (9.3-22)
Clutch box (9.3-27)
S16 (9.3-21)
Boot (9.3-24)

(3) Mount the parts assembled in step (2).
Fix the clutch box to the slider pipe.


Slider pipe (9.3-25)
P4 (9.3-28)
P8 (9.3-29)
Seal nut (9.3-30)

* Since the slide pipe is made of stainless steel and the seal nut is made of plastic, tightening the nut crooked will cause it to be cross-threaded. Make sure the nut is on straight before tightening it.

* Assemble this unit taking great care not to cause cross-threading of the shield nut.

(4) Screw up the boot joint (9.3-22)
Tighten the boot joint (9.3-22) using the M16 pipe nut. Make sure that the cutout in the joint faces UP.

5.2.5 Overload-Detection Adjustment

(1) How Overloading is Detected

Since a reflection-type light element is used for the detection element, this unit detects changes in the amount of light bouncing back of the reflector plate. Overloading is detected by setting the threshold value.

(2) Overload Mechanism

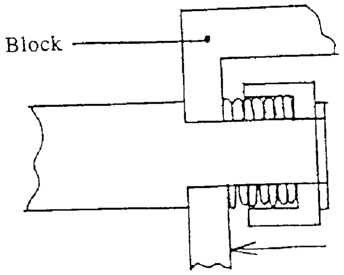
The overload-detection unit is housed in the block. The mechanism consists of the following:

- Overload-detection board (9.6-45)
- Spring retainer plate (9.6-31)
- Overload spring (9.6-32)
- M8 nut (9.6-30)
- Block (9.6-18)
- Slide pipe (9.3-25)
- Clutch (9.3-31~33)
- Clutch box (9.3-27)

The overload detection mechanism functions as follows:

1. The light element is mounted on the overload-detection board, and the reflecting label fix to the spring retainer plate so that as the relative positions of the element and spring retain plate change, so is the amount of light that is reflected. The light element is fixed to the bloc
2. The slide pipe is pressed against the block by the overload spring. If a pressure greater th the force of this spring occurs in the fluid circuit, it compresses the overload spring, there changing the relationship between the spring retainer plate (reflective label) and the li element.

   The load at which the mechanism functions is adjusted by how far the M8 nut is tighten (Initial loading setting)



* Since the overload spring is a compression spring, tightening the M8 nut increases resistance. The slide pipe is pressed against the block by this spring pressure.

(3) Adjusting Overload Detection Pressure

Three items need to be adjusted to change the overload detection pressure:

1. The initial loading setting, which is adjusted by the tightening of the overload spring (the position of the M8 nut);
2. The positioning of the overload-detection board;
3. The adjustment of the variable resistors on the control board.

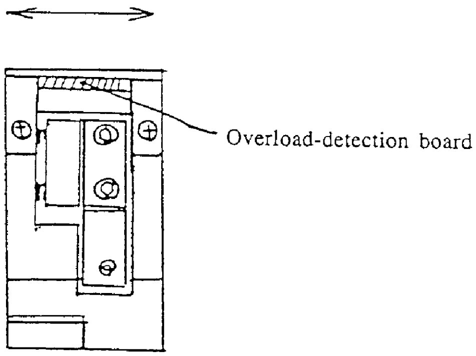
1) Set the initial loading of the overload detection unit.

The tighter the M8 nut, the greater is the starting load. Normally, the nut should be tightened to the position shown in section 5.2.3 (2).

2) Measure the input voltage at pin 11 of IC6 on the control board.

To check that the overload-detection element is functioning, move the overload detection board in the directions shown by the arrows.

Check that the voltage at pin 11 of IC6 changes as you move the board.



3) Move the overload-detection board to the left (as shown in the above figure).

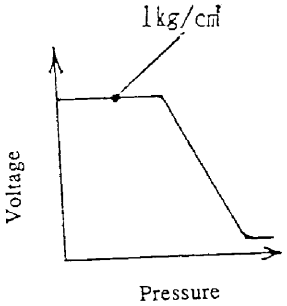
While checking the voltage at pin 11 of IC6, move the overload-detection board to the right, then semi-tighten the board in position just before the point where the voltage starts to drop.

4) Measure the pressure and position the board.

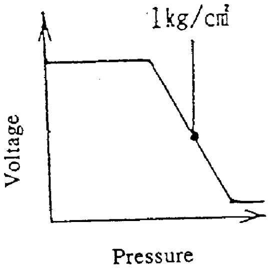
Get ready a new 50ml syringe and pressure meter, then start the unit at a setting of 150m h and measure the pressure. Position the board so that the greatest change in the voltage inp to pin 11 of IC6 occurs at a pressure of 1kg/cm^2.

* Set the position of the board.

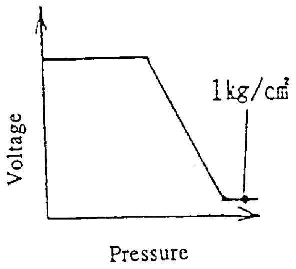
Check at which position the 1kg/cm^2 pressure can be detected, then adjust the position of t board so that detection takes place during the voltage change.



Before the change



During the change



After the change

- Measure the point where the voltage changes, then adjust the position of the board.

  Before the change: Move the board to the right if the pressure is high

  After the change: Move the board to the left if the pressure is low

5) Adjust the variable resistor on the control board so that the alarm is issued at a pressur 1kg/cm^2.

Check that pin 10 of IC6 is set to 1V.

(Use VR5 to change the voltage. See section 5.1.5.)

Place the pressure jig in position and apply a pressure of 1kg/cm^2 to the slider. Make sure the pressure is applied by the syringe pump itself from about 0.8kg/cm^2. (The error fact measuring may be greater because of differences in the degree to which the spri compressed.)

Stop at 1kg/cm^2 and adjust variable resistor VR6 to achieve a voltage of 1V at pin 11 of

6) Measure the pressure two or three times to check that it is in the range of 0.9 to 1.2kg/cm^2.

* If the pressure is not in the range 0.9 to 1.2kg/cm^2:

- carry out the adjustments from step 5) again.
- If it is not possible to achieve the correct value by carrying out the adjustments in step 5), start again from step 4).

* If you cannot achieve the correct adjustment, adjust the tightness of the M8 nut as described in step 1) (tightening the nut in the clockwise direction increases the pressure; loosening it in the counterclockwise direction decreases the pressure).

* If the overload mechanism simply does not function, check the assembly of the slider unit. (See section 6.3.4 for how to remove the slider, then check the positions of the clutch box and clutch.)

Measuring instruments

- Pressure meter: pressure range, 0.0 to 3.0kg/cm^2
- New Terumo 50ml syringe (the 20 and 30ml syringes are not appropriate for the following range of adjustment and cannot be used.)

Always connect a new Terumo 50ml syringe to the pressure meter for positioning in the pump. Set the filling amount to 150.0ml/hour, then press the START switch. Carry out the necessary adjustments so that the readout on the pressure meter is in the range 0.9 to 1.2kg/cm^2 when the overload alarm is issued.

* Although the range 0.9 to 1.2kg/cm^2 differs from the occluded detection pressure of greater than 0.7kg/cm^2 given in the specifications, this value includes a tolerance so that a pressure of more than 0.7kg/cm^2 is satisfied no matter what the filling amount or the type of syringe

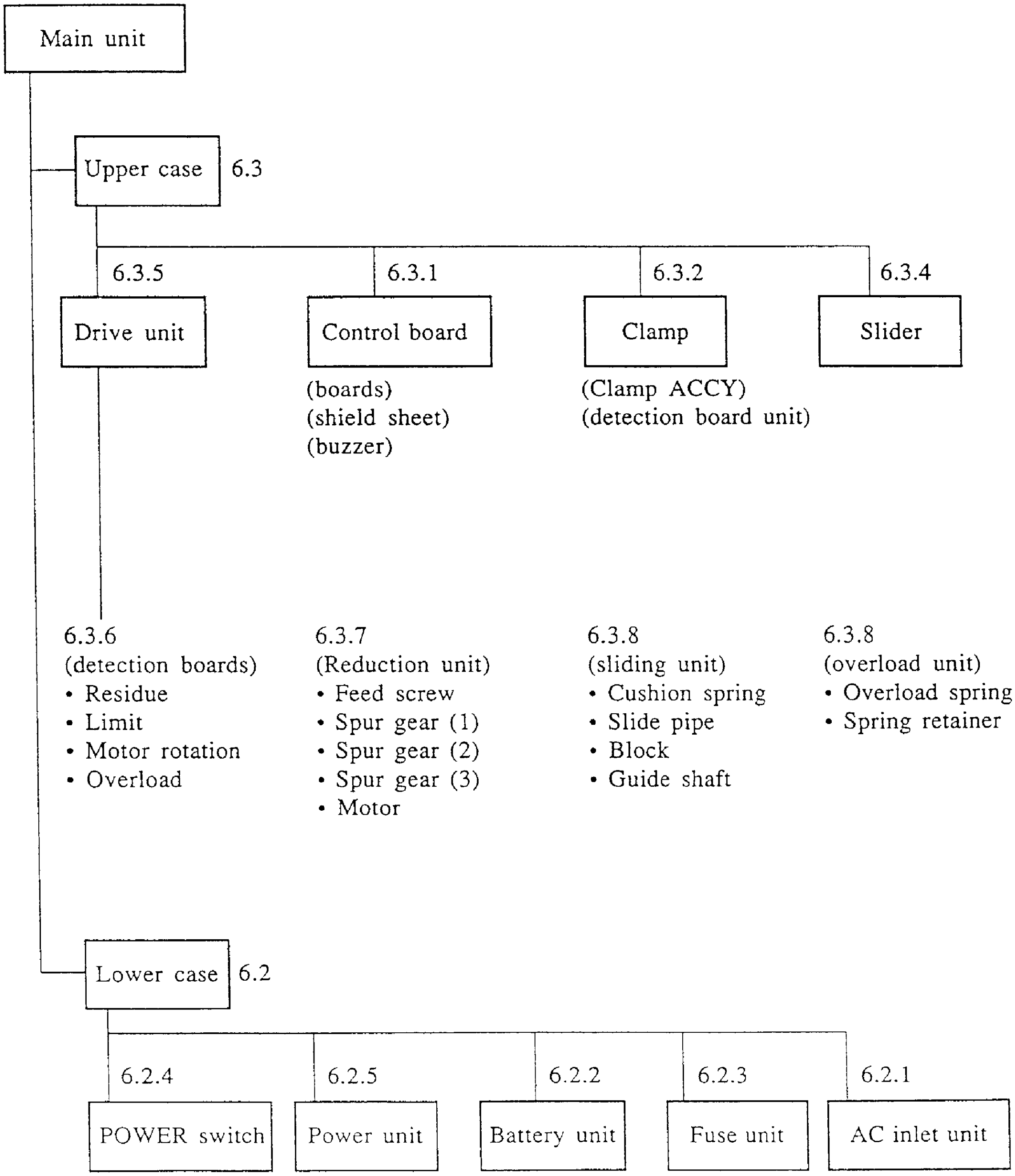
5.3 Cautions on the Use of Gortex

Since the STC-523 is fully sealed, 1mm-diameter holes are drilled in the grips in the bottom case to allow air in, and the holes then covered with Gortex.
Although Gortex has the ability to let air pass but prevent the passage of water, this feature is lost when wetting agents (surfactants) get onto it, and you must therefore avoid cleaning with such surfactants.

* Surfactants (wetting agents): Agents used to reduce surface tension
Example: neutral detergents, soaps, etc.

6. DISMANTLING PROCEDURES

This section describes the procedures for dismantling the STC-523. If you are working on moulded parts such as the upper or lower cases, place soft material such as cotton underneath them to prevent scratches.
See the parts tables and exploded diagrams for the names and locations of parts.
See exploded diagram 9.xx for parts with names followed by (9. -).


Main unit
Upper case
6.3
6.3.5
Drive unit
6.3.1
Control board
(boards)
(shield sheet)
(buzzer)
6.3.2
Clamp
(Clamp ACCY)
(detection board unit)
6.3.4
Slider
6.3.6
(detection boards)
• Residue
• Limit
• Motor rotation
• Overload
6.3.7
(Reduction unit)
• Feed screw
• Spur gear (1)
• Spur gear (2)
• Spur gear (3)
• Motor
6.3.8
(sliding unit)
• Cushion spring
• Slide pipe
• Block
• Guide shaft
6.3.8
(overload unit)
• Overload spring
• Spring retainer
Lower case
6.2
6.2.4
POWER switch
6.2.5
Power unit
6.2.2
Battery unit
6.2.3
Fuse unit
6.2.1
AC inlet unit

Detection Function Checklist

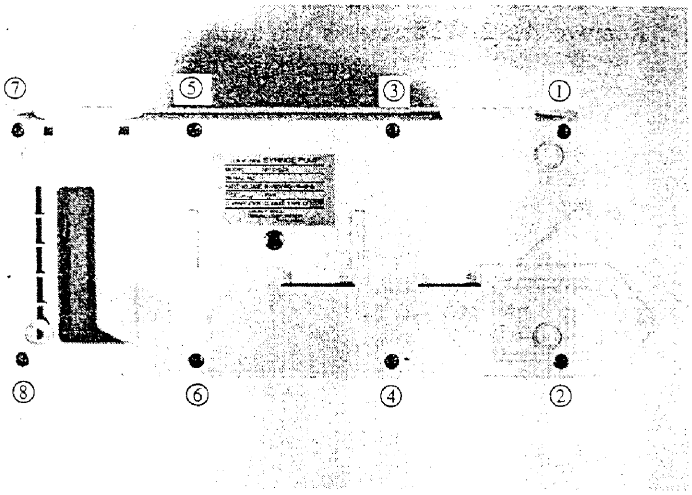
Work		Overload alarm	Residue alarm	Buzzer frequency	Syringe type detection	Battery voltage drop alarm	Rotation detection	Limit detecti
6.3.1 Control board	Remove	△	△	△	△	△	—	—
	Replace	○	○	○	○	○	—	—
6.3.2 Clamp	Remove	—	—	—	△	—	—	—
	Replace	—	—	—	○	—	—	—
6.3.3 Syringe detection board	Remove	—	—	—	△	—	—	—
	Replace	—	—	—	○	—	—	—
6.3.4 Slider	Remove	△	—	—	—	—	—	—
	Replace	△	—	—	—	—	—	—
6.3.5 Drive unit	Remove	△	△	—	—	—	△	△
	Replace	○	○	—	—	—	○	○
6.3.6 Detection board	Remove	○	○	—	—	—	○	○
	Replace	○	○	—	—	—	○	○
6.3.7 Reduction unit	Remove	△	△	—	—	—	○	
	Replace	△	△	—	—	—	○	
6.3.8 Overload unit	Remove	○	○	—	—	—	○	○
	Replace	○	○	—	—	—	○	○

○ - - - Adjust △ - - - Check

Use this chart to check the various detection units if the equipment has been dismantled and then re-assem

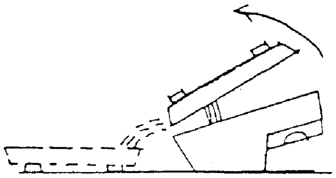
6.1 Removing the Cases

(1) Remove the 8 screws (two M4x15 panhead screws and six M4-25 screws with rubber pads).

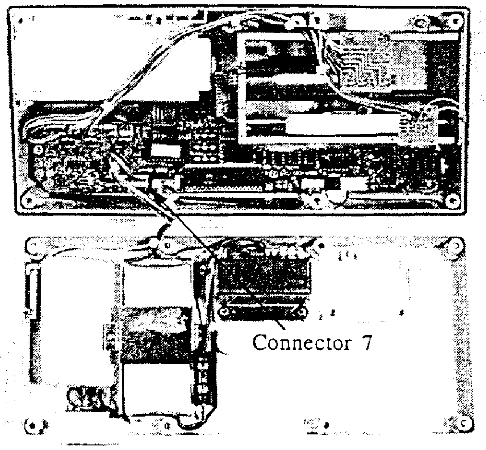


⑤ and ⑦: M4x15
Others: M4x25

(2) Pull the bottom case toward you to disengage the hooks. Take care not to force the connector (7), which links the upper and lower cases.



(3) Remove the control board and connector 7 from the upper case, then separate the upper and lower halves of the case.



(4) Remove the sealing rubber (9.3-67) from the upper case.

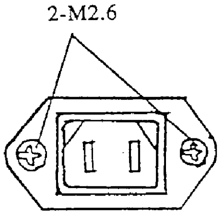
* Replace both the case sealing rubber and the rubber pads from the case screws.

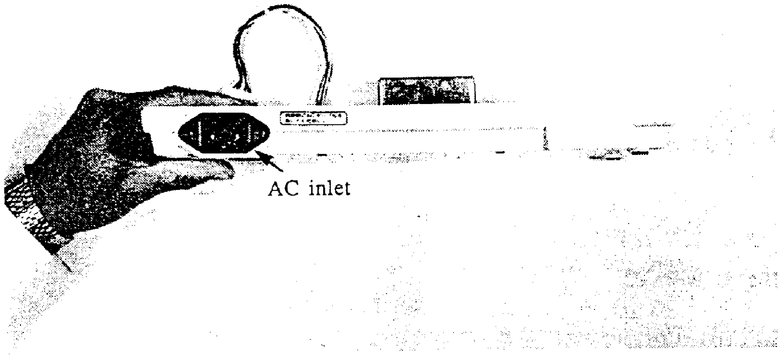
Make sure when re-assembling the pump that the sealing rubber is securely fitted into the groove before tightening the eight M4 screws. Tighten the screws in the sequence in which they are numbered in the figure.

6.2 Dismantling the Lower Case

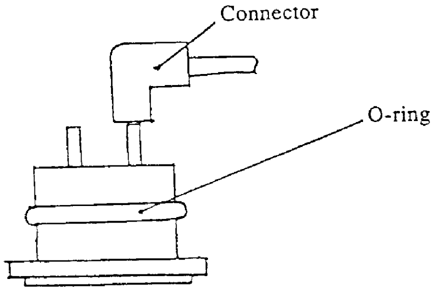
6.2.1 Removing the AC Inlet

1. Remove the 2-M2.6 screws and push the AC inlet out from inside.



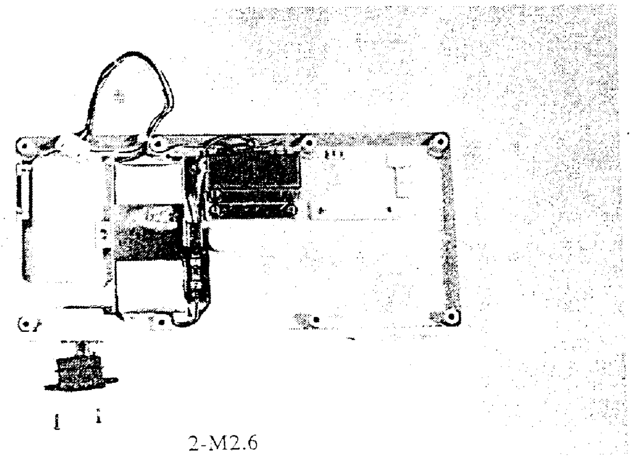


2. Pull the connector off the AC inlet.



3. Replace the O-ring S-26 (9.3-26) in the above figure.

* Small Phillips screwdriver

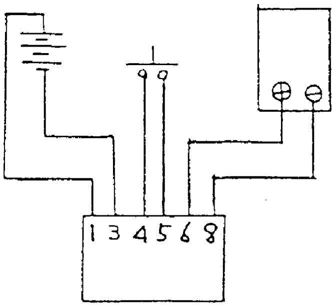


Assembly Advice:

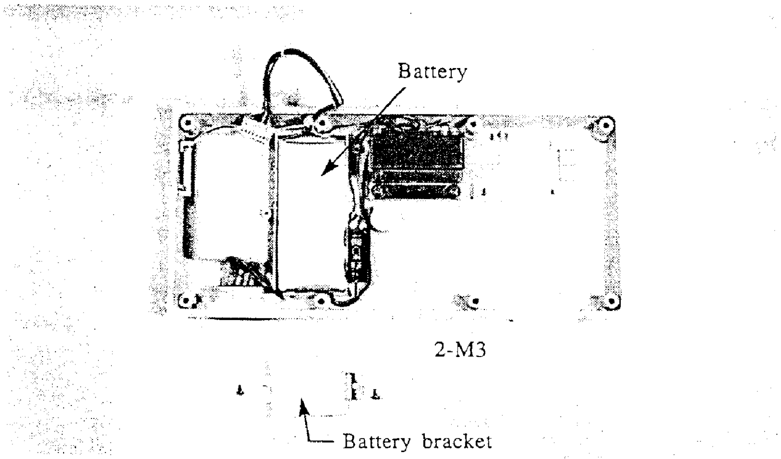
Fit the O-ring into the groove in the lower case before tightening the screws. The AC inlet acts as a stopper and should therefore be fully tightened.

6.2.2 Removing the Battery

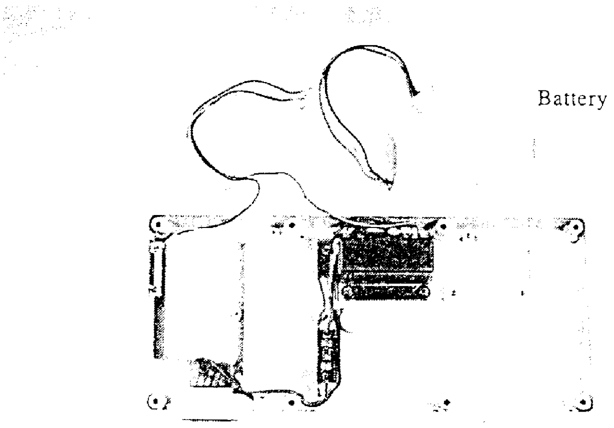
1. Remove all cables leaving pins 1 and 3 of connector 7 in place.
   - * Remove the power switch and the DC power supply (pins 4, 5, 6 and 8).
   - * You can choose to remove pins 1 and 3 from connector 7. But if you do, take care not to short across pins 1 and 3.



2. Remove the 2-M3 screw retaining the battery bracket to remove the bracket.



3. You can now remove the battery.
   - * Medium-size Phillips screwdriver

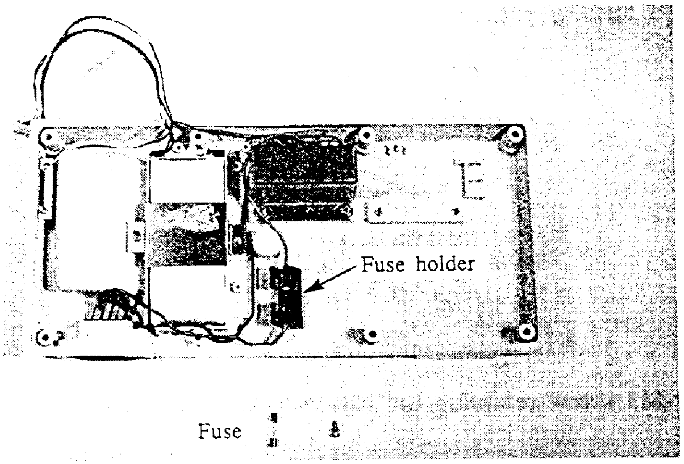


Assembly Advice:

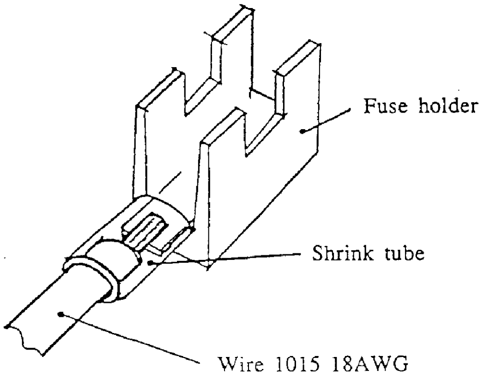
Take care not to short the battery terminals. Insert the pins into connector 7 first.

6.2.3 Removing the Fuse Unit

1. Take the fuse out of the holder to reveal the M3 screw at the bottom of the holder. Remove M3 screw.
   * Screwdriver

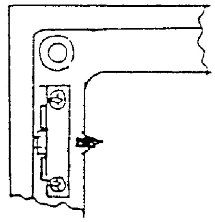

Fuse holder
Fuse

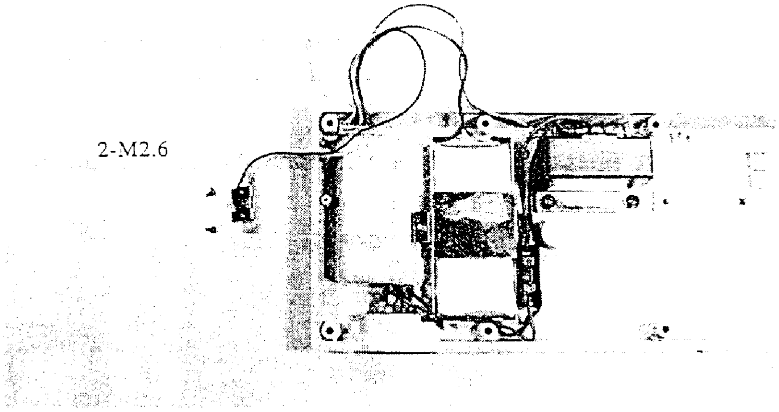
2. Remove the shrink tube from the fuse holder terminal, then remove (desolder) the wire.
   * Soldering iron and cutter.


Fuse holder
Shrink tube
Wire 1015 18AWG

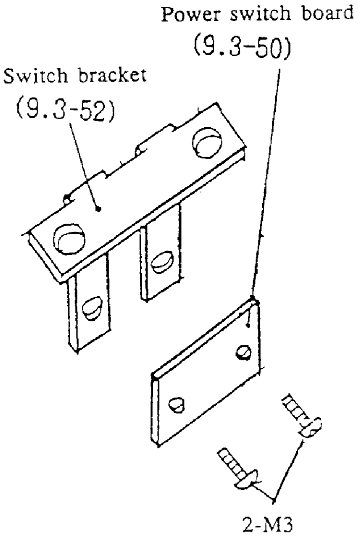
6.2.4 Removing the Power Switch

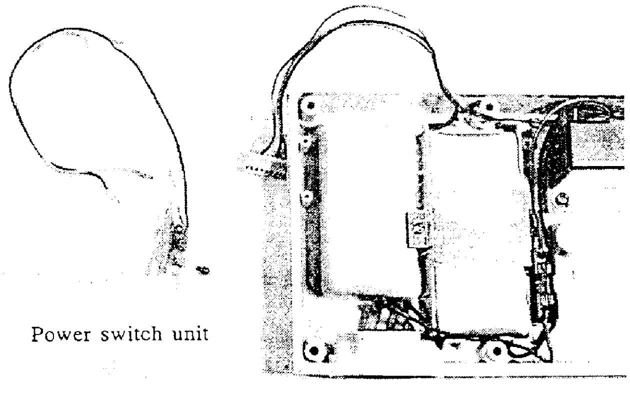
1. Remove the 2-M2.6 screws holding the power switch bracket.
2. Remove the power switch bracket in the direction of the grips, slip the top of the switch through the guide hole in the lower case, then pull it up.
   (Remove in the direction shown by the arrows in the figure.)





3. Remove the 2-M3 screws holding the power switch bracket and power switch board. Pull out pins 4 and 5 from connector 7.
   * Small and medium-sized Phillips screwdriver


Power switch board
(9.3-50)
Switch bracket
(9.3-52)
2-M3

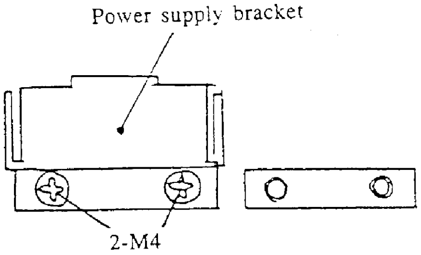

Power switch unit

Assembly Advice:

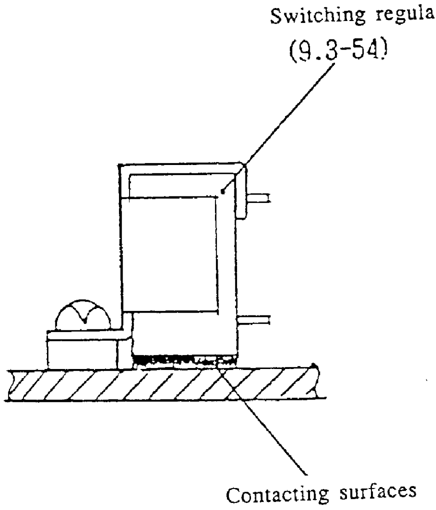
When mounting the power switch bracket on the lower case, position the power switch so that it clicks when pushed.

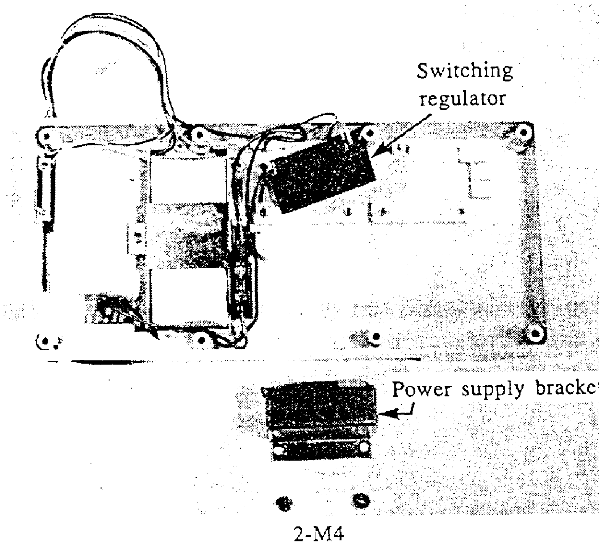
6.2.5 Removing the Power Unit

1. Remove the 2-M4x5 screws holding the power supply bracket.


Power supply bracket
2-M4

2. Remove the power supply bracket and switching regulator.


Switching regulator
(9.3-54)
Contacting surfaces


Switching
regulator
Power supply bracke
2-M4

Assembly Advice:
Coat the surface in contact with the lower case with silicon grease to absorb heat.

6.2.6 Removing the Power Switch Sheet

1. The power switch sheet is held in place with pressure-sensitive adhesive with adhesive arou edges. Use a sharp instrument to remove it.

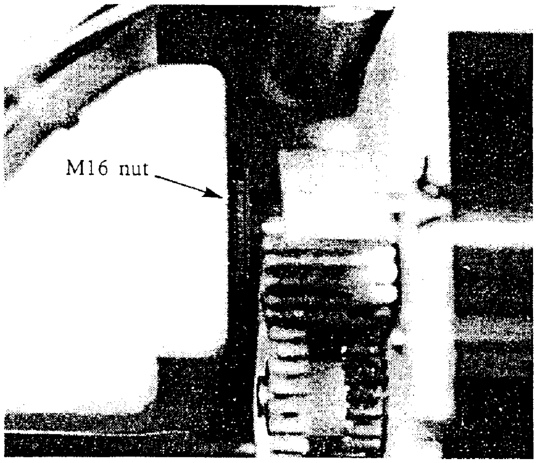
Assembly Advice:
Clean off any remaining KE45 adhesive, then clean the wipe the surfaces to be stuck with al Affix the power switch sheet, then coat around it with KE45 to plug up any gaps.

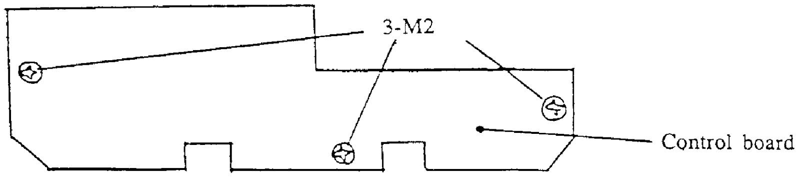
6.3 Dismantling the Upper Case

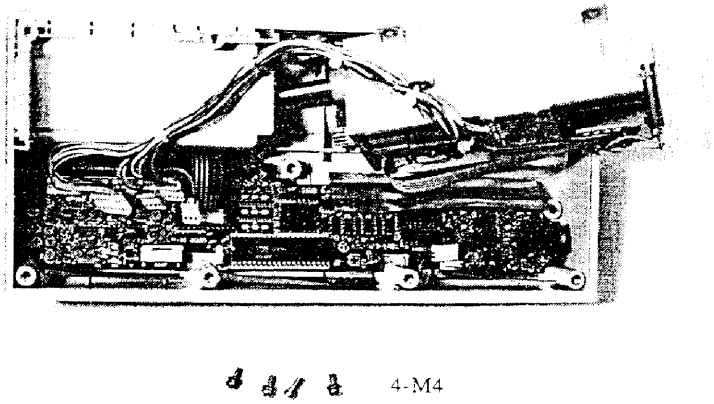
6.3.1 Removing the Control Board

1. Remove the M16 but (9.3-34) holding the boot joint (9.3-22), then remove the 4-M4x10 screws holding the chassis (9.6-1). Now pull out the slider (9.3-26) as far as it will go and rotate the chassis by 90° (use cellophane tape, etc. to hold it in this position).
2. Remove the 3-M2 screws from the top of the control board, then remove connectors CON1-8.
3. Remove the control board and shield sheet.

   * M16 spanner, small and medium-sized Phillips screwdrivers, and adhesive tape.







Assembly Advice:

- Temporarily position the control board, then adjust its position from outside so that it is aligned with the LEDs.
- Use the M16 nut to fix the boot joint. Make sure when doing so that the cutout in the joint comes at the top.
- Check the action of the slider and adjust the position of the board, etc., if it does not slide smoothly.

6.3.1.1 Removing the Buzzer

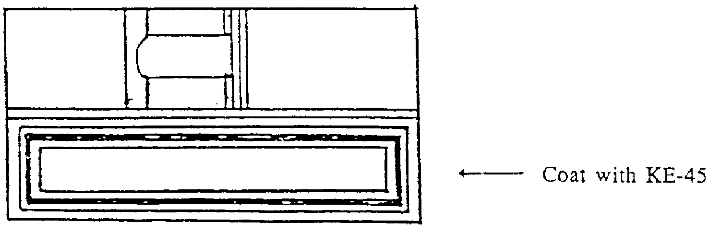
The buzzer is located under the control board.

1. Remove the control board (See section 6.3.1, Removing the Control Board).
2. The buzzer is fixed in position using Araldite. Insert a sharp tool under it to remove it.

6.3.1.2 Removing the Panel Keyboard

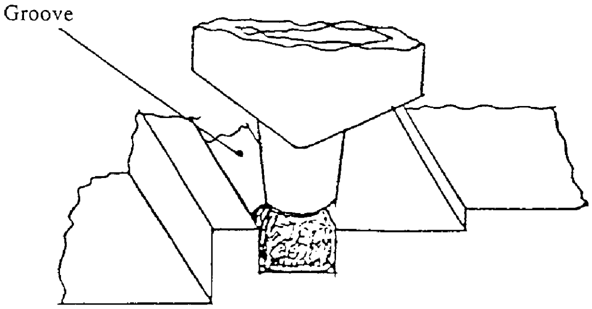
1. The panel keyboard is attached using KE-45 around the edges. Insert a sharp tool around the edges to remove it.
2. Remove all traces of KE-45 from the case.

Advice for Reapplying the Panel Keyboard:
Coat all around the groove in the upper case with KE-45. Stick the panel keyboard in place making sure that the gap is equal at right and left, top and bottom. Wipe off any excess KE-45.



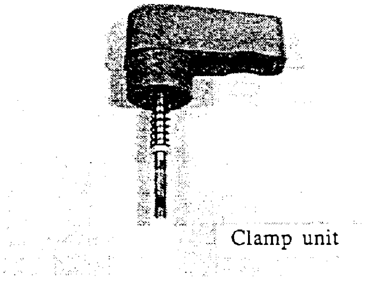
Press the panel keyboard into place so that the excess adhesive is squeezed out to the sides

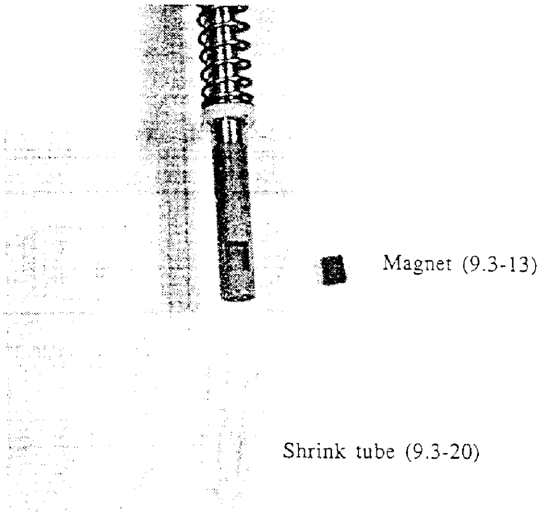
To apply the KE-45, fill a syringe with it, then squeeze it into the groove.



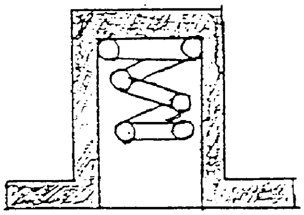
6.3.2 Dismantling the Clamp Unit

1. Push the clamp unit (9.3-11~20) down and twist it clockwise about 60° (until it stops). In this position, lift the clamp up and out.
2. Remove the shrink tube from the end of the clamp shaft and remove the magnets.



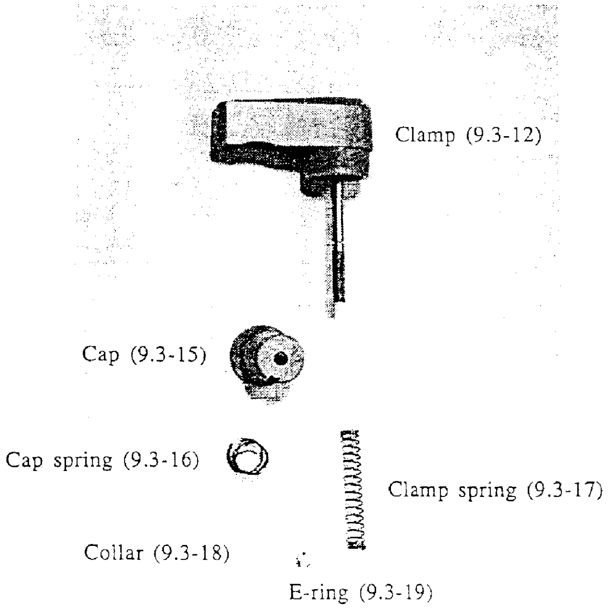

Magnet (9.3-13)
Shrink tube (9.3-20)

3. Remove the E-ring so that the clamp unit can be dismantled as shown at right.
   * Collar, clamp spring, cap, clamp and cap spring



The cap spring is heteromorphic. The large end is to be inserted as far as it will go into the cap.

Assemble the parts so that the colored surfaces of the magnets are visible.

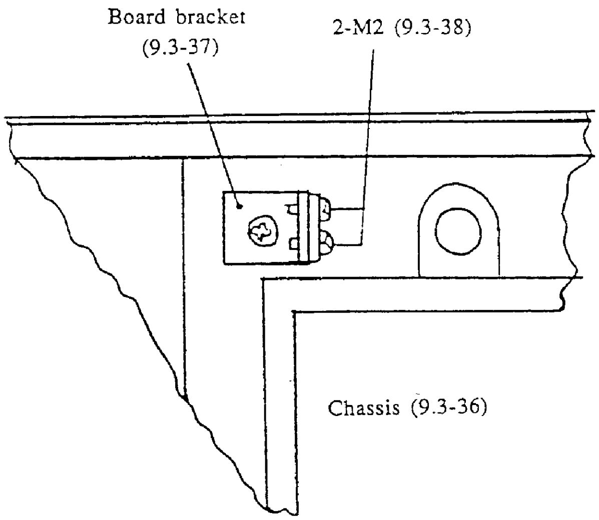

Clamp (9.3-12)
Cap (9.3-15)
Cap spring (9.3-16)
Clamp spring (9.3-17)
Collar (9.3-18)
E-ring (9.3-19)

Assembly Advice:

Take care not to melt plastic parts when heat-shrinking the shrink tube which holds the magnets in place.

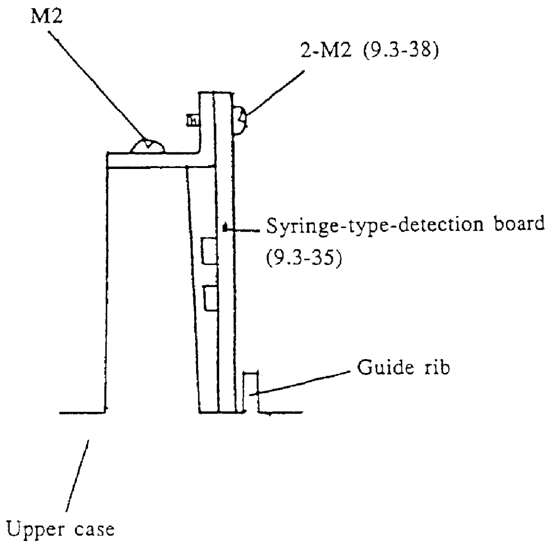
6.3.3 Removing the Syringe-Detection Unit

1. Remove the M2 screw holding the board, then disconnect CON2 from the control board and lift the syringe-detection board out.
2. Remove the M2 screw holding the syringe-detection board to the board bracket.
   - * Small Phillips screwdriver


Board bracket
(9.3-37)
2-M2 (9.3-38)
Chassis (9.3-36)

* Slide the board in along the rib in the upper case for positioning the syringe-detection board.

* After assembly, check the syringe sizes (see section 5.1.4).

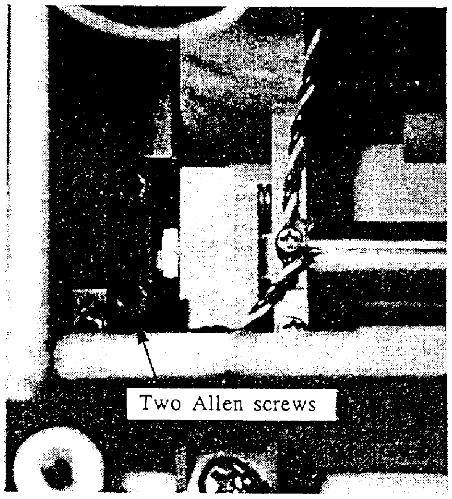

M2
2-M2 (9.3-38)
Syringe-type-detection board
(9.3-35)
Guide rib
Upper case

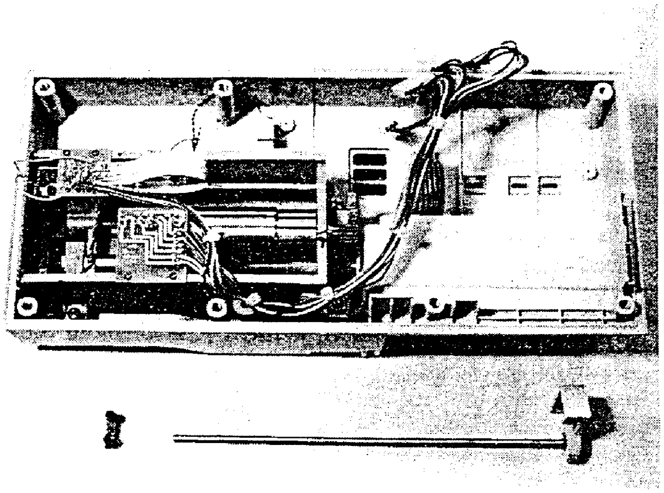
6.3.4 Removing the Slider Unit

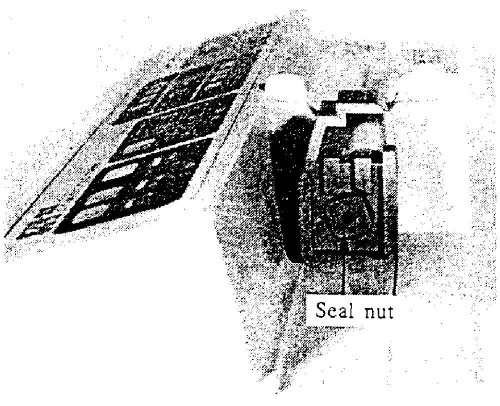
1. Press the clutch level (9.3-32) lightly to open it, then lift the slider out.
2. Loosen the boot joint nut and the two Allen feed screws holding the clutch shaft (9.3-31). Pull the clutch lever and pull out the clutch shaft.
3. Remove the sealing nut holding the clutch box, then pull the whole slider unit off the slide pipe (see 9.3-21~34).

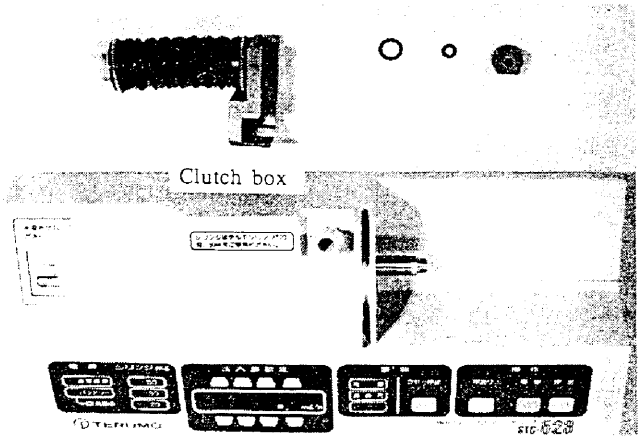
Assembly Advice:

- Take care not to cross the threads when tightening the seal nut.
- Make sure the clutch lever is as far as possible from the clutch box (otherwise, the overload mechanism will fail to operate).



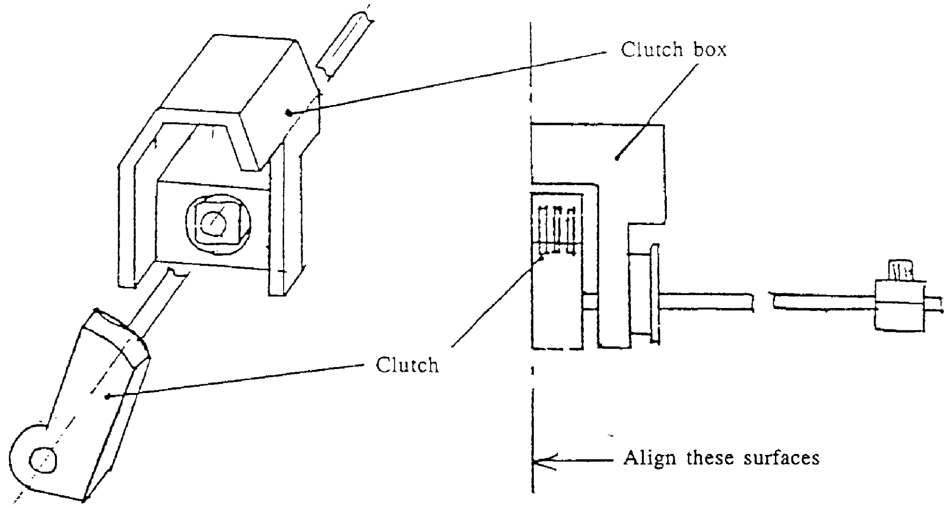






Assembly Advice:

- The seal nut is made of plastic and mounting it at an angle on the slide pipe will result in the threads being crossed. Carefully straighten the nut on the pipe before attempting to tighten it.
- Make sure the clutch lever is as far as possible from the clutch box.

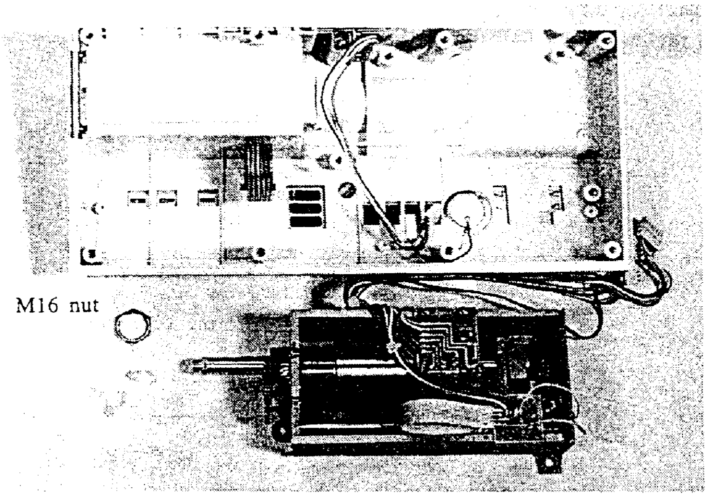


Position the clutch box and clutch as shown in the figure, then fix the clutch in place with the feed nuts.

- When inserting the clutch, it must pass through the O-ring (P4) in the seal nut. Take care not to damage this O-ring.

6.3.5 Removing the Drive Unit

1. After dismantling the slider unit, remove the 4-M4x10 screws holding the chassis, then remove the drive unit from the upper case.

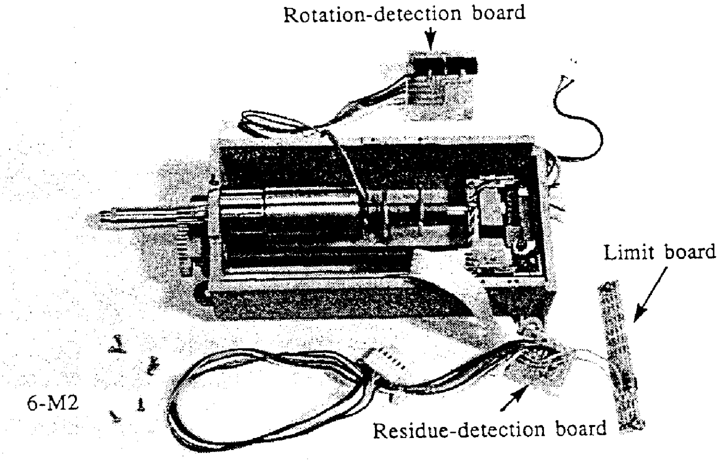


Drive unit (9.3-4)

* The M16 nut can now be removed

6.3.6 Removing the Detection Boards

1. Remove the S6-M2 screws holding the detection boards, then remove the boards.
2. Cut the tie-wraps.
3. Desolder the leads from the limit board (pins 5 and 6 on the residue board).
4. The residue-detection board is connected by flexible cable to the relay board, which is screwed to the block. Take care not to crease the flexible cable.



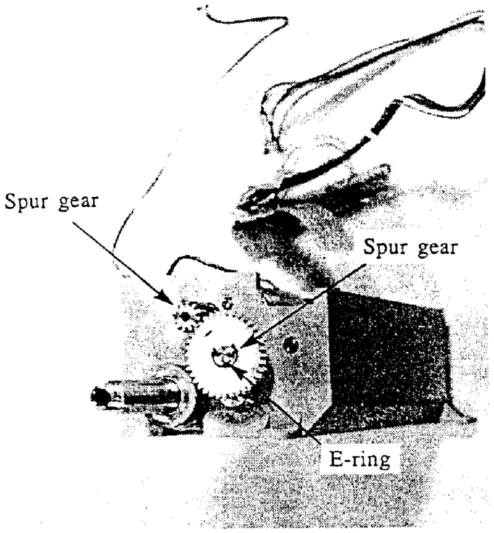
Assembly Advice:

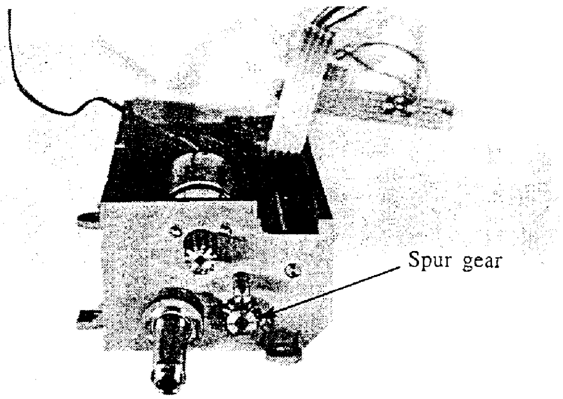
- Adjust the relative positions so that the photointerruptor on the rotation-detection board does not come in contact with the encoder (see section 5.2.1).
- Adjust the relative positions so that the photointerruptor on the residue-detection board does not come into contact with the block (see section 5.1.3).
- Take care not to crease the flexible cable as creases will break the wires in the cable.

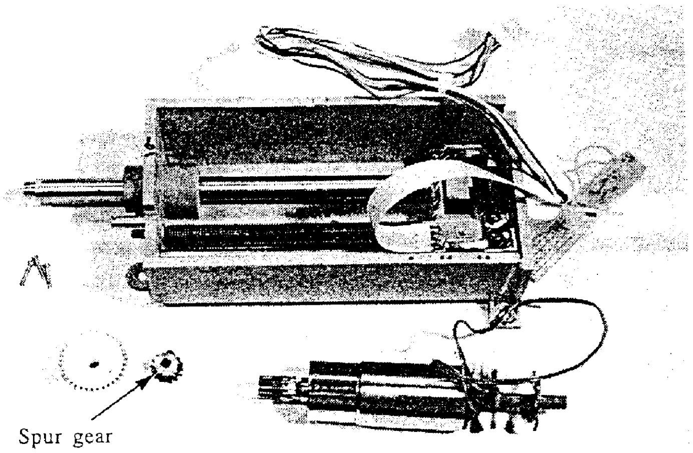
6.3.7 Dismantling the Reduction Unit

1. Remove the E-ring from the spur gear (2).
2. Loosen the 3-M2 screws holding the motor, then lift out the motor with the spur gear (1) attached (they cannot be separated).
3. Loosen the 2-M3 set-screws for spur gear (3) then pull out the feed screw. Take care not to lose the collar (9.6-5), which acts as a washer.

   * Small Phillips screwdriver, M3 hex wrench, and needle-nose pliers for removing the E-ring





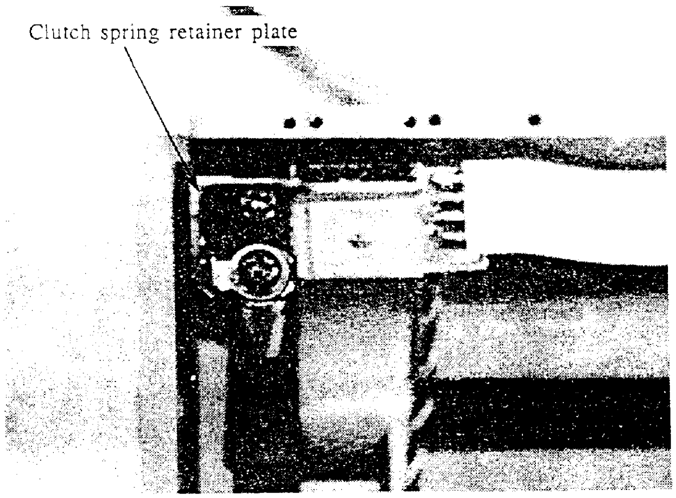


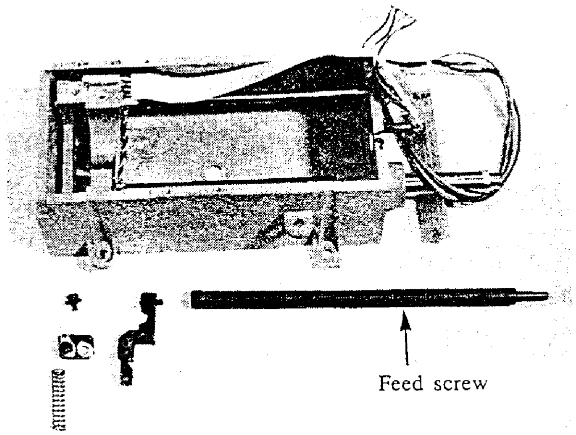
Assembly Advice:

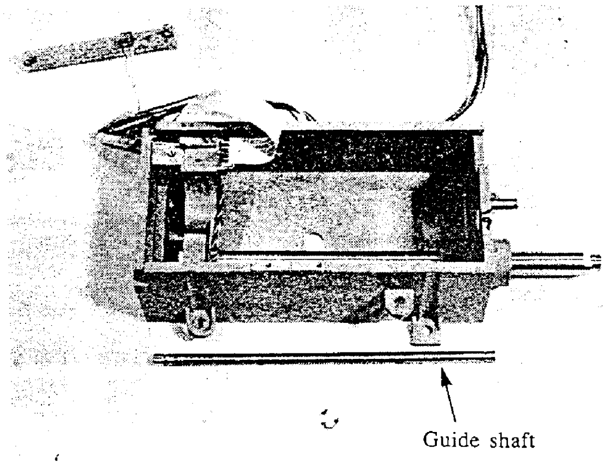
- Set the gap between spur gear (1) and motor at 0.5mm (see section 5.2.2).
- Leave play of about 0.2mm between spur gear (3) and the feed screw (see section 5.2.2).

6.3.8 Removing the Block

1. Remove the clutch spring retainer plate (9.6-24) from the block (9.6-18), then remove the feed nut (9.6-3). The feed screw (9.6-2) is now free and can be removed from the back of the unit.
   * Note that the feed screw is covered with grease.
2. Remove the E-ring (9.6-22) from the guide shaft (9.6-21) and remove the guide shaft. The silicon tube (9.6-19) can now be removed.

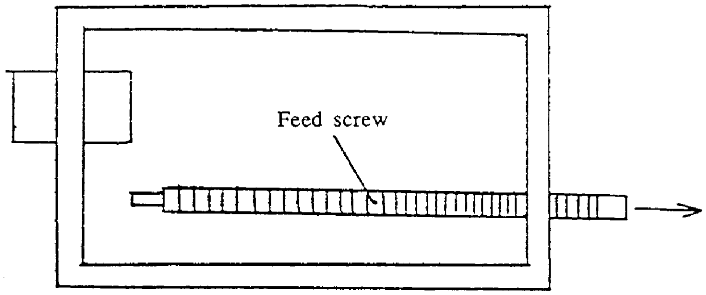

Clutch spring retainer plate




Guide shaft

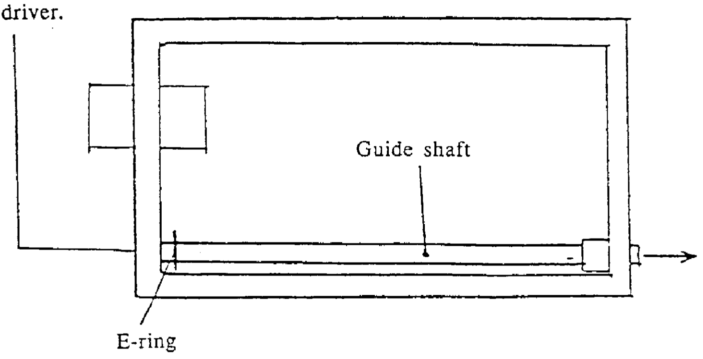
Assembly Advice:

When inserting the feed screw, thread it gently through the DU bush taking care not to exert unnecessary force.

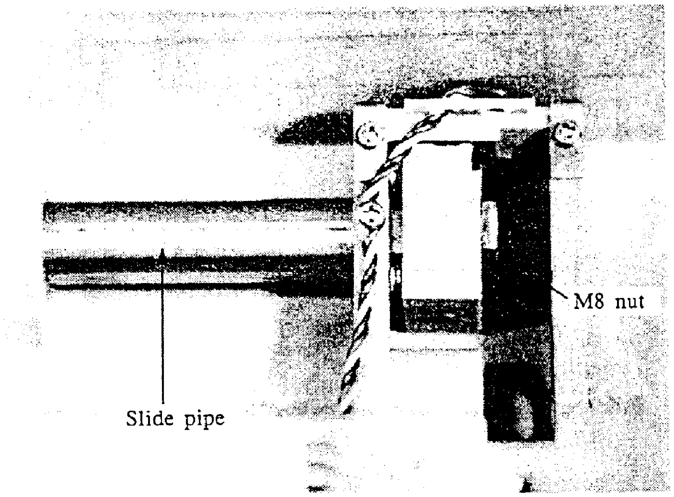


Pull out the feed screw in the direction of the arrow.

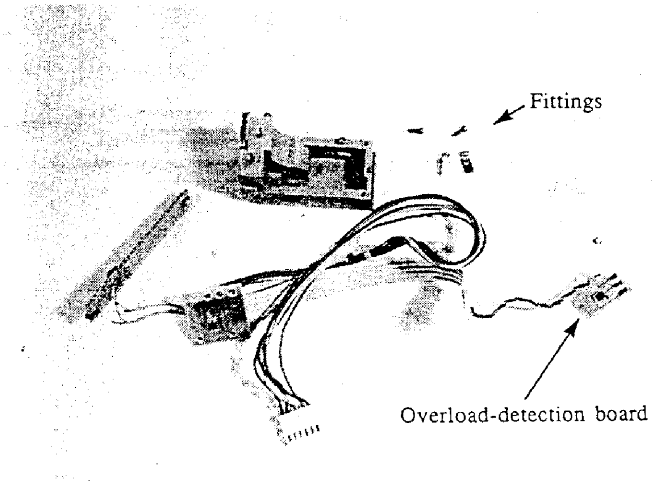
Push the end with a screwdriver.


Guide shaft
E-ring

3. Remove the slide pipe (9.3-25) which is fixed to the block (9.6-18). Remove the M8 nut, then pull out the slide pipe.
   * Separates into slide pipe, spring retainer plate, overload spring, and M8 nut.



4. Remove the block from the chassis.
   - Remove the board fittings (9.6-28) and remove the overload-detection board (9.6-32).
   - Remove the M3 screw (9.6-42) holding the relay board (9.6-44).



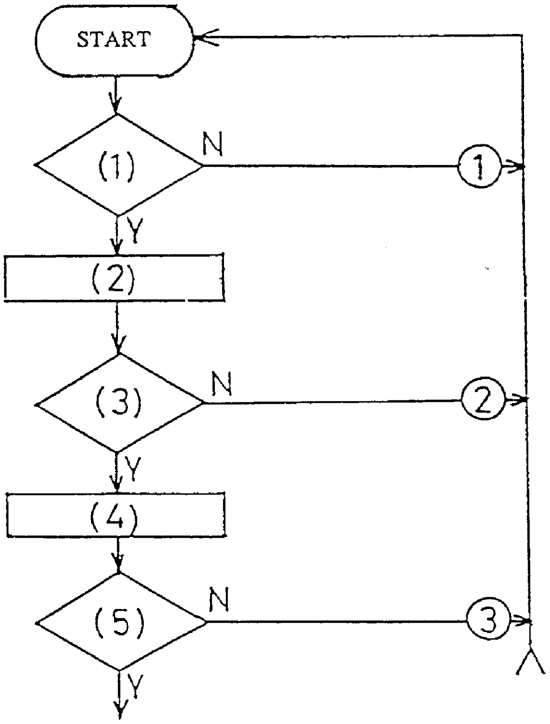
Assembly Advice:

Tighten the M8 nut to the point where the spring retainer plate is level with a line extended from the feed nut (see section 5.2.3(2)).

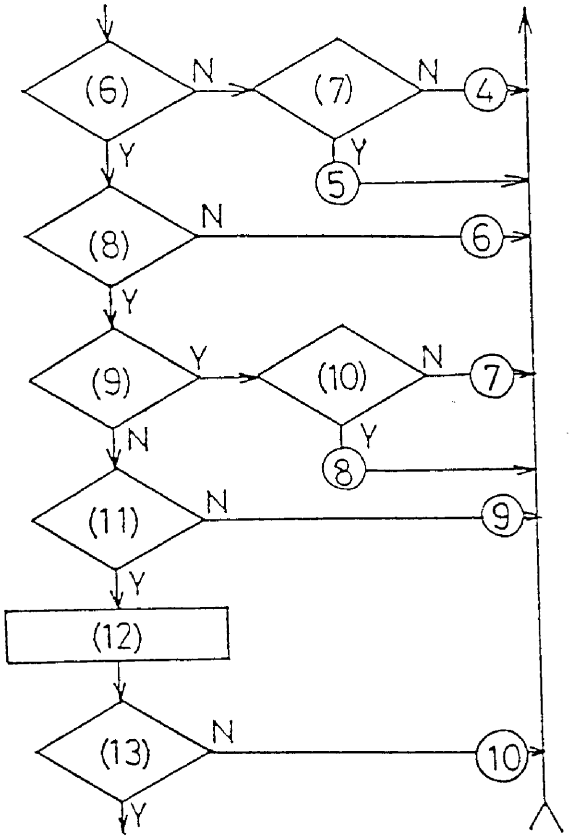
7. TROUBLESHOOTING

The purpose of this section is to locate faulty assemblies. If you are analyzing faults at the component level, refer to Chapter 4, Operating Principle, then follow the signal flowpath on the circuit diagrams.

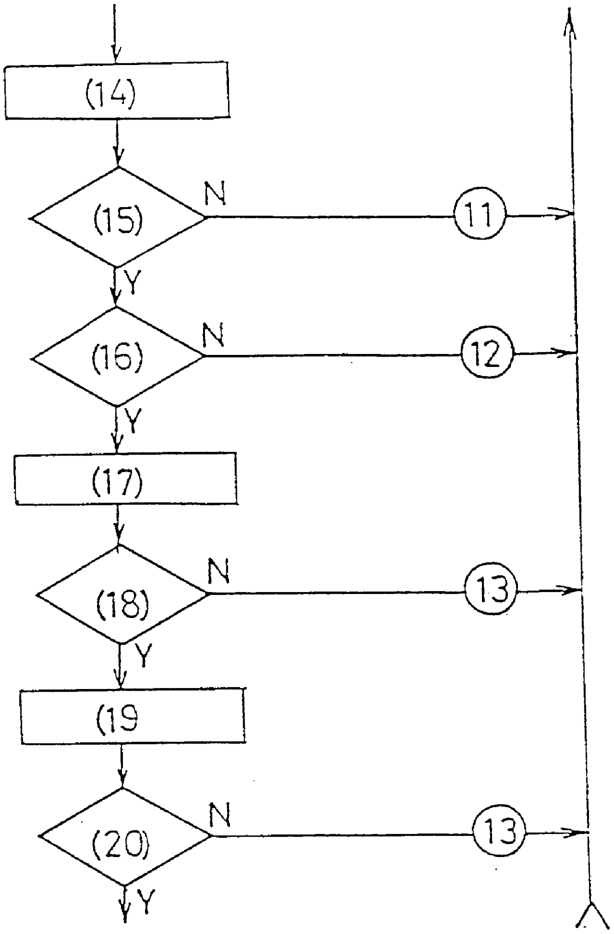
7.1 Flowcharts



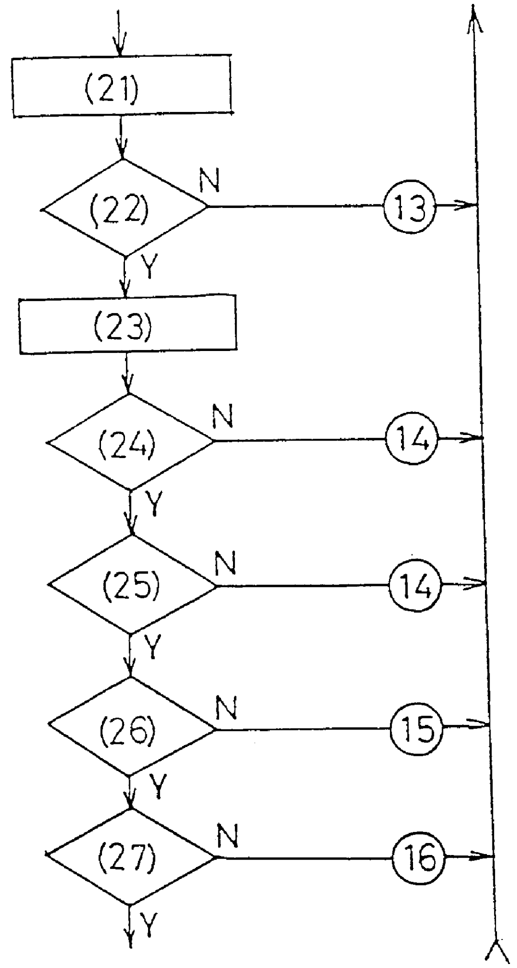
(1) When the clutch is engaged, the slider moves laterally; when disengaged, it will not move.
(2) Connect to an appropriate power supply
(3) Does the CHARGE LED light?
(4) Turn ON the POWER switch.
(5) Does the POWER LED light?



(6) Does the self-check function (*1) start?
(7) Is [Er. 1] displayed?
(8) Is the self-check (*1) executed OK?
(9) Is [Er. 2] displayed, and does the buzzer sound continuously?
(10) Does the motor rotate? (Open the case or listen carefully to check.)
(11) Is [0.0] displayed, is the STOP LED blinking, and are the [50], [30], and [20] LEDs all blinking?
(12) Disconnect the AC power cable.
(13) Are the CHARGE and POWER LEDs OFF but the BATTERY LED ON?


(14)
(15)
N
11
Y
(16)
N
12
Y
(17)
(18)
N
13
Y
(19
(20)
N
13
Y

(14) Re-connect the AC power cable.
(15) Does the buzzer sound for about 2 seconds if the START or FAST switches are pressed?
(16) Does the filling setting (*2) function correctly?
(17) Mount a 50ml syringe.
(18) Does the [50] ml syringe LED light?
(19) Mount a 30ml syringe.
(20) Does the [30] ml syringe LED light?



(21) Mount a 20ml syringe?

(22) Does the [20] ml syringe LED light?

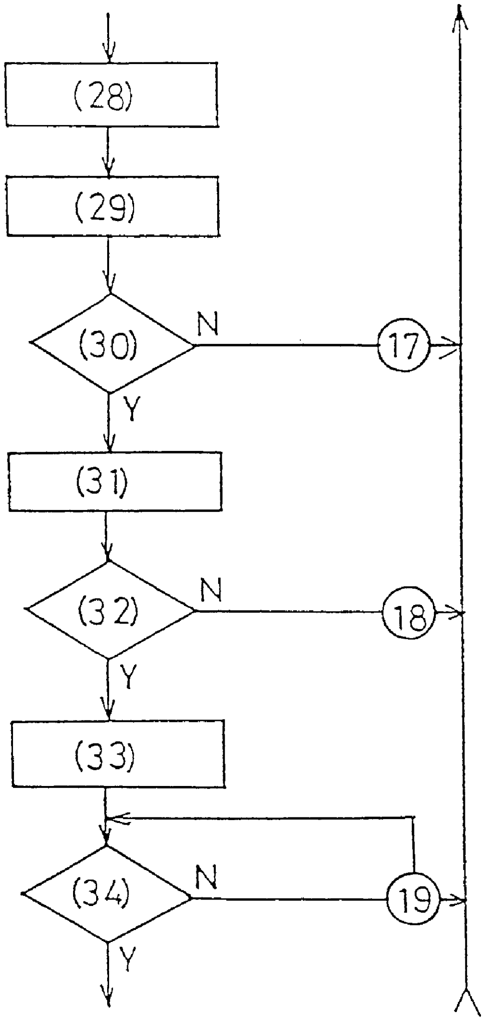
(23) Set the filling to 150.0ml/h.

(24) If you press and hold the FAST switch, does the slider move quickly and is the integrated volume displayed?

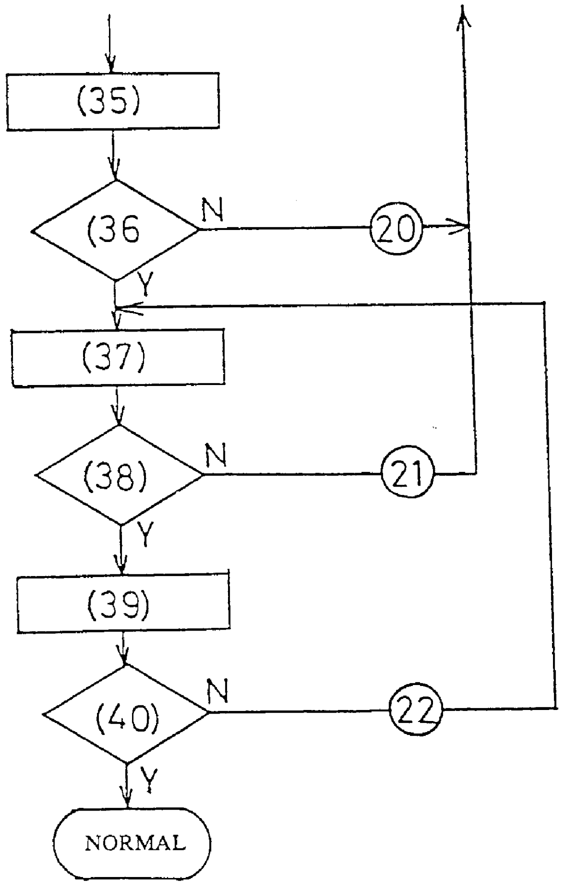
(25) Does operation start when the START switch is pressed?

(26) If you move the clamp to the top position, does the motor stop, the [50], [30], and [20] ml syringe LEDs all blink, and the buzzers sound continuously?

(27) Does the buzzer stop if you press the Buzzer STOP switch?



(28) Mount a 50ml syringe.
(29) Move the slider to just before the end.
(30) Does the RESIDUE LED blink and the buzzer sound intermittently?
(31) Press the START switch then the Buzzer STOP switch to turn OFF the buzzer.
(32) Shortly after starting, does the OVERLOAD lamp blink, the buzzer sound, and the motor stop?
(33) Move the slider to the right, connect a pressure meter to a new 50ml syringe, set the filling to 150.0ml/h, then press the START switch.
(34) When the pressure meter shows a reading in the range of 0.9 to 1.2kg/cm^2, does the OVERLOAD LED blink, the buzzer sound, and the motor stop?



(35) Disconnect the AC power cable, turn OFF the power switch, connect an adjustable powe. supply to connector 7, set the supply to +8V, then turn ON the power switch (see the adjustments in section 5.1.1).

(36) Slowly lower the voltage. Is the BATTERY alarm issued at about 6.5V and do all functions stop at about 6V?

(37) Connect the battery to connector 7 and re-connect the AC power cable.

(38) Does the self-check function start?

(39) Disconnect the AC power cable.

(4) Does the BATTERY LED light?

*1 The Self-Check Function

This function checks the memory, LED, and motor rotation.
The memory and motor rotation checks are carried out by the pump itself and the [Er] message is displayed if any abnormality is encountered. Check the LEDs visually yourself.

The self-check is executed in the following sequence:

> Motor rotation → [50] ON → [30] ON → [20] ON → [1] lights in the 100s position → [8] lights in the 10s position → [8] lights in the 1s position → [8] lights in the 1/10ths position [RESIDUE] ON → [BATTERY] ON → [FAST] ON → [START] ON → motor rotation

*2 Filling Settings

The step is incremented by 1 each time the switch is pressed; the steps count up automatically if the switch is pressed and held. The maximum setting of 150.0ml is selected by pressing the 4th digit twice.

7.2 Troubleshooting By Symptoms

No.	Cause	Checking	Action
1	Displaced compression spring	Visually	Reposition the compression spring.
	Damaged feed screw	Visually	Replace the drive unit.
	Bent rod	Visually	Replace the drive unit.
	Faulty mounting position of drive unit	Visually	Adjust the mounting position.
2	Faulty AC power cord	Power outlet not appropriate	Replace the AC power cord.
	Blown fuse	Visually	Replace the fuse.
	Faulty DC power supply	12VDC output not 12V	Replace the DC power supply.
	Faulty insertion of connector CON7	Disconnect and reconnect 2 or 3 times to diagnose the fault.	Wipe the connector with alcohol, etc.
	Faulty control board (STC-523-1A11)	If not one of the above, the control board is faulty.	Replace the control board.
3	Faulty power switch	Faulty if no continuity between pins 4 and 5 of CON 7 when the power switch is pressed.	Replace the power switch unit.
	Faulty insertion of connector CON7	Disconnect and reconnect 2 or 3 times to diagnose the fault.	Wipe the connector with alcohol, etc.
	Faulty 12V power circuit	Is the Vbe of Tr3 about 0.6V?	Replace the control board.
	Faulty 12V power circuit	Is the Vbe of Tr4 about 0.6V?	Replace the control board.
	Faulty LEDs or LED drive circuit	Is the voltage between the anode of D17 and ground about 70mV and does this change to about 5V when the AC power cord is disconnected? (Does Tr5 turn ON when the AC power cord is connected?)	Replace the control board.
	Faulty control board (STC-523-1A11)	Faulty control board if none of the above.	Replace the control board.
4	Faulty 5V power circuit	Is the output at TP12 about 5V?	Replace the control board.
	Faulty control board (STC-523-1A11)	Faulty control board if none of the above.	Replace the control board.
5	Faulty control board (STC-523-1A11)	Faulty control board if Er1 displayed.	Replace the control board.

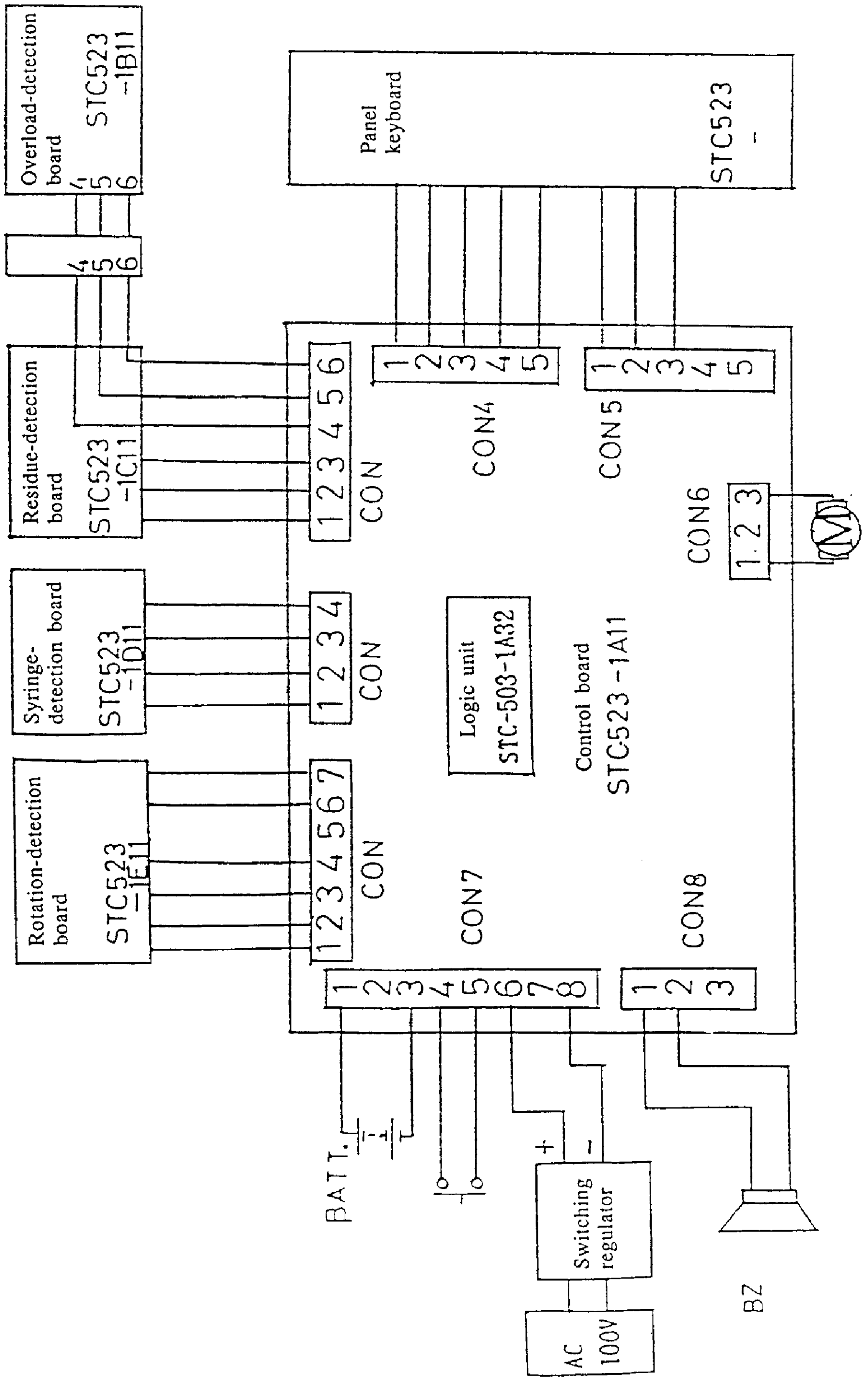
No.	Cause	Checking	Action
6	Faulty CPU, LED drive circuit, or LED	LEDs do not light in the correct self-check sequence.	Replace the control board.
	Faulty buzzer circuit	Is the volume set to maximum?	Set the volume to maximum.
	Faulty insertion of connector CON7	Disconnect and reconnect 2 or 3 times to diagnose the fault.	Wipe the connector with alcohol, etc.
	Faulty control board (STC-523-1A11)	The output at pin 32 of IC1 does not change from HIGH to LOW when the overload alarm is issued.	Replace the control board.
	Faulty logic board	270µs ± 10µs	Replace the control board.
	Faulty buzzer	Faulty buzzer if none of the above.	Replace the buzzer.
7	Cables, etc., catching on encoder	Visually check the rotation of the encoders while repeatedly turning the power switch ON and OFF.	Adjust the position of the part where the cables are catching.
	Faulty control board (STC-523-1A11)	Monitor the output from pin 31 of IC1 and TP4 while the self-check is being executed.	Replace the control board.
	Faulty control board (STC-523-1A11)	Check the output at TP3 while the self-check is being executed (refer to the waveforms on page 8-5).	Replace the control board.
	Faulty control board (STC-523-1A11)	Check the output at TP9 while the self-check is being executed (refer to the waveforms on page 8-5).	Replace the control board.
	Faulty insertion of connector CON6	Disconnect and reconnect 2 or 3 times to diagnose the fault.	Wipe the connector with alcohol, etc.
	Faulty motor	Faulty motor if none of the above.	Replace the motor unit.
8	Faulty insertion of connectors CON1 and 3	Disconnect and reconnect 2 or 3 times to diagnose the fault.	Wipe the connector with alcohol, etc.
	Faulty rotation-detection board (STC-523-1 11)	Check the output of TP7 and TP8 while manually rotating the encoder (see waveforms on page 8-5).	Replace the rotation-detection board.
	Faulty residue-detection board (STC-523-1 11)	The voltage between pins 3 and 2 on the board is not about 1.1V.	Replace the residue-detection board.
	Faulty control board (STC-523-1A11)	Check the output waveform at TP3 (see waveforms on page 8-5).	Replace the control board.
	Faulty control board (STC-523-1A11)	Faulty control board if none of the above.	Replace the control board.

No.	Cause	Checking	Action
9	Faulty insertion of connector CON2	Disconnect and reconnect 2 or 3 times to diagnose the fault.	Wipe the connector with alcohol, etc.
	Faulty syringe-detection board (STC-523-1 11)	The output at pins 1 and 2 on the board does not change even when the clamp is moved up and down.	Replace the syringe-detection board.
	Faulty control board (STC-523-1A11)	Faulty control board if none of the above.	Replace the control board.
10	Faulty insertion of connector CON7	Disconnect and reconnect 2 or 3 times to diagnose the fault.	Wipe the connector with alcohol, etc.
	Drop in battery voltage	Check the battery voltage.	Charge
11	Faulty panel keyboard	Check from the panel's tail that, when the START switch is pressed, there is continuity between pin 4 of CON4 and pin 1 of CON5 and, when the FAST switch is pressed, between pin 2 of CON4 and pin 1 of CON5. Note: Take care not to remove the plating on the tail.	Replace the panel keyboard.
	Faulty contacts in connectors CON 4 and 5	Disconnect and reconnect 2 or 3 times to diagnose the fault.	Wipe the connector with alcohol, etc.
	Faulty control board (STC-523-1A11)	Faulty control board if none of the above.	Replace the control board.
12	Faulty panel keyboard	Check from the panel's tail that, when the filling setting switch is pressed, there is continuity between the pins corresponding to each of the switches in CON4 and CON5. (See page 8-8) Note: Take care not to remove the plating on the tail.	Replace the panel keyboard.
	Faulty contacts in connectors CON 4 and 5	Disconnect and reconnect 2 or 3 times to diagnose the fault.	Wipe the connector with alcohol, etc.
	Faulty control board (STC-523-1A11)	Faulty control board if none of the above.	Replace the control board.
13	Faulty insertion of connector CON2	Disconnect and reconnect 2 or 3 times to diagnose the fault.	Wipe the connector with alcohol, etc.
	Faulty syringe-detection board (STC-523-1D11)	Does the output of pins 1 and 2 on the board change with each type of syringe?	Replace the syringe-detection board /Adjust the control board.
	Faulty control board (STC-523-1A11)	Faulty control board if none of the above.	Replace the control board.

No.	Cause	Checking	Action
14	Faulty control board (STC-523-1A11)	Check the output signals at pin 31 of IC1 and TP4 (see page 8-xx).	Replace the control board.
	Faulty drive unit	Visually	Adjust or replace the faulty item.
15	Faulty control board (STC-523-1A11)	Does the level of the output at pin 7 of IC7 change to LOW?	Replace the control board.
16	Faulty panel keyboard	Check from the panel's tail that, when the Buzzer STOP switch is pressed, there is continuity between pin 5 of CON4 and pin 1 of CON5. Note: Take care not to remove the plating on the tail.	Replace the panel keyboard.
	Faulty insertion of connectors CON4 and 5	Disconnect and reconnect 2 or 3 times to diagnose the fault.	Wipe the connectors with alcohol, etc.
	Faulty control board (STC-523-1A11)	Faulty control board if none of the above.	Replace the control board.
17	Faulty residue-detection board (STC-523-1 11)	Does the level at pin 1 on the board change to HIGH?	Replace the residue-detection board.
	Faulty control board (STC-523-1A11)	Does the level at pin 23 of IC2 change to HIGH?	Replace the control board.
18	Faulty drive unit	Does the spring retainer plate move?	Adjust or replace the faulty parts.
	Faulty overload-detection board (STC-523-1 11)	The level of pin 13 of IC6 on the control board does not change to LOW when the spring retainer plate is moved.	Replace the overload-detection board.
19	Faulty compression spring	Carry out adjustments as in section 5.2.4.	Replace the compression spring.
	Faulty mounting of slider unit	Refer to the Assembly Advice in Disassembly procedure 6.3.4.	Re-adjust.
20	Faulty control board (STC-523-1A11)	Carry out the adjustments as in section 5.1.1.	Replace the control board.
	Faulty control board (STC-523-1A11)	Does the output at TP5 change as the voltage is lowered?	Replace the control board.
21	Faulty AC power cable	Securely insert the AC power cord.	
	Faulty control board (STC-523-1A11)	Faulty control board if none of the above.	Replace the control board.
22	Faulty insertion of connector CON7	Disconnect and reconnect 2 or 3 times to diagnose the fault.	Wipe the connector with alcohol, etc.

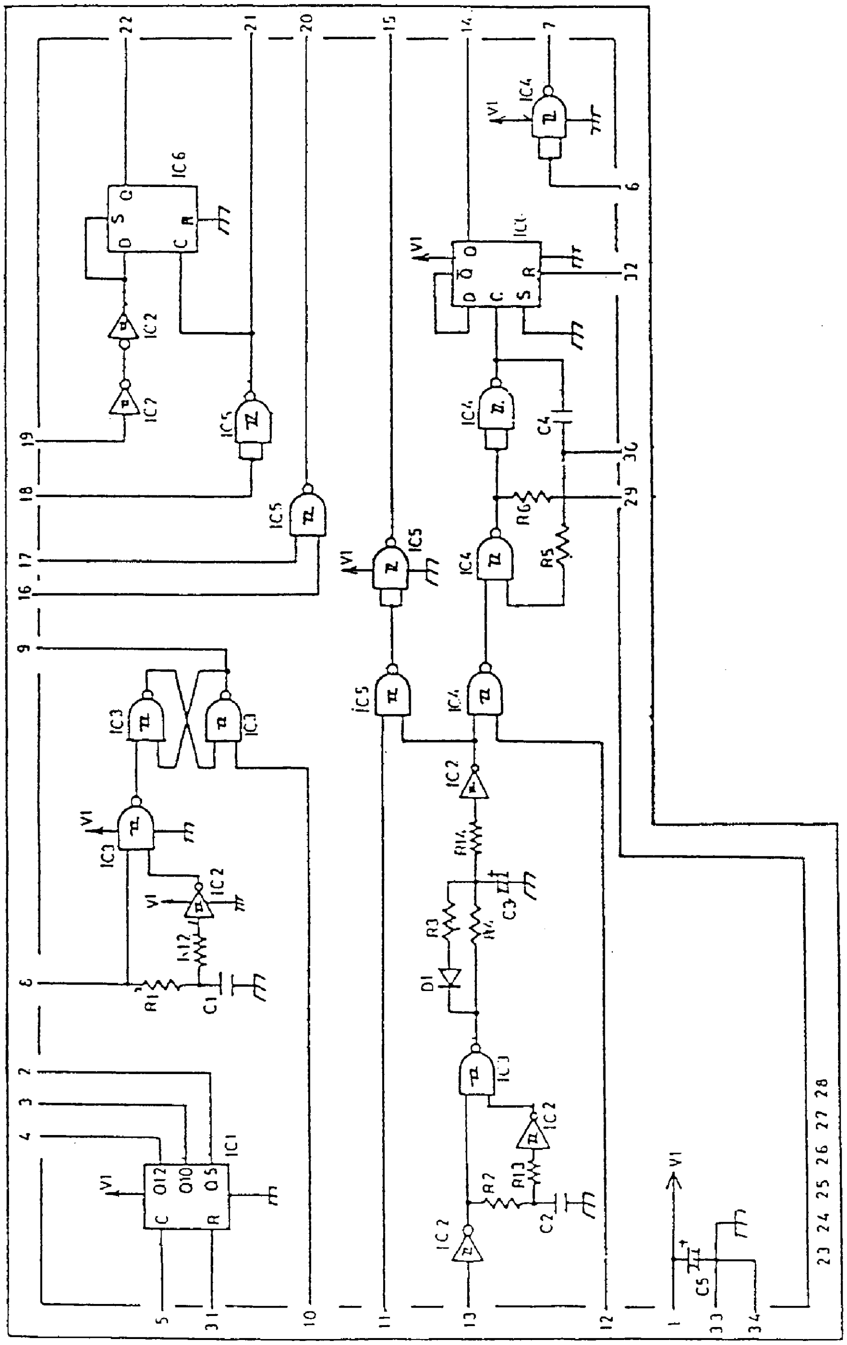
8. CIRCUIT DIAGRAMS

8.1 Overall Connection Diagram


Overload-detection board
STC523 -1B11
4 5 6
4 5 6
Panel keyboard
STC523 -
Residue-detection board
STC523 -1C11
1 2 3 4 5 6
CON
1 2 3 4 5
CON4
1 2 3 4 5
CON5
1 2 3
CON6
M
Syringe-detection board
STC523 -1D11
1 2 3 4
CON
Logic unit
STC-503-1A32
Control board
STC523 -1A11
Rotation-detection board
STC523 -1E11
1 2 3 4 5 6 7
CON
CON7
CON8
1 2 3 4 5 6 7 8
1 2 3
BATT.
+
-
Switching regulator
AC 100V
BZ

8.3 Logic Unit Circuit Diagram

Control board: IC3 STC-503-1A32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31
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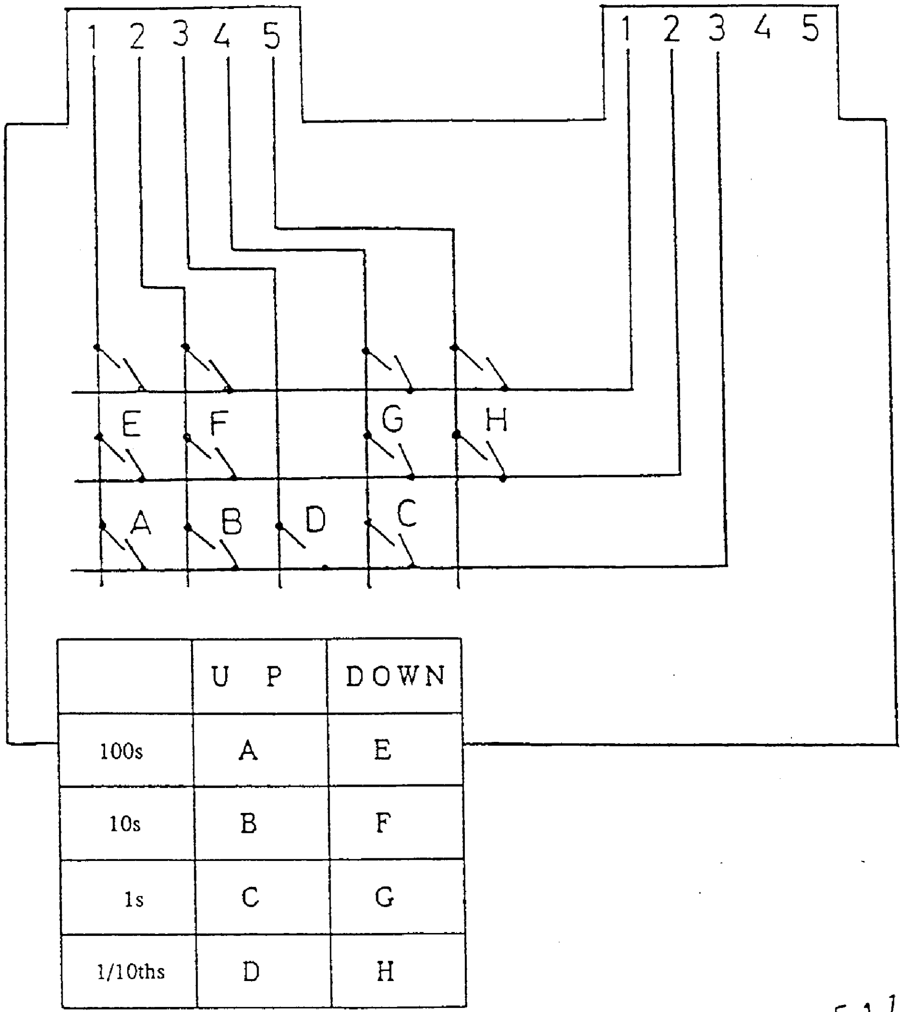
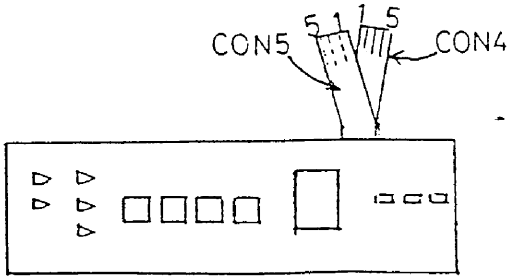
11
13
12
1
33
34
23 24 25 26 27 28
IC1
IC2
IC3
IC4
IC5
IC6
V1
D
S
Q
C
R
Q12
Q10
Q5
R1
R12
C1
R3
R4
R14
C3
D1
R7
R13
C2
R5
R6
C4
C5

8.4 Panel Keyboard

STC-523-1F01

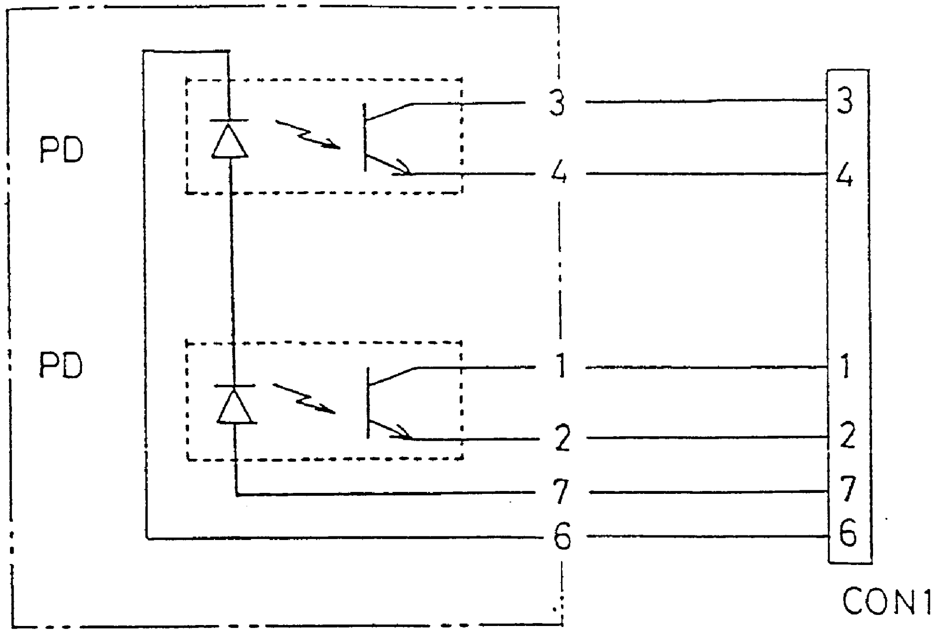

1 2 3 4 5
1 2 3 4 5
E
F
G
H
A
B
D
C

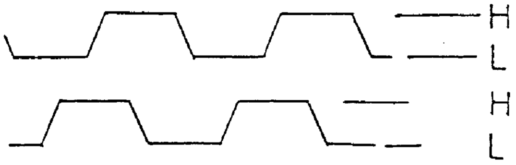
	U P	DOWN
100s	A	E
10s	B	F
1s	C	G
1/10ths	D	H


CON5
5 1
1 5
CON4

8.5 Rotation-Detection Unit Circuit Diagram and Waveforms

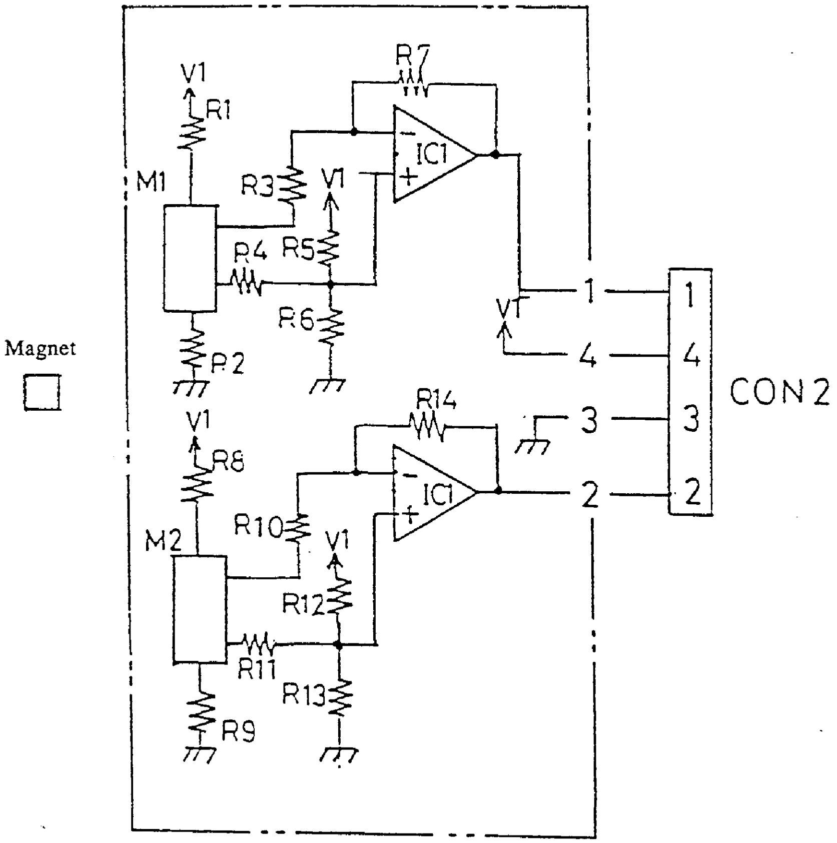
STC-523-1E11 board


PD
PD
3
4
1
2
7
6
3
4
1
2
7
6
CON1



8.6 Syringe-Type-Detection Unit Circuit Diagram and Truth Table

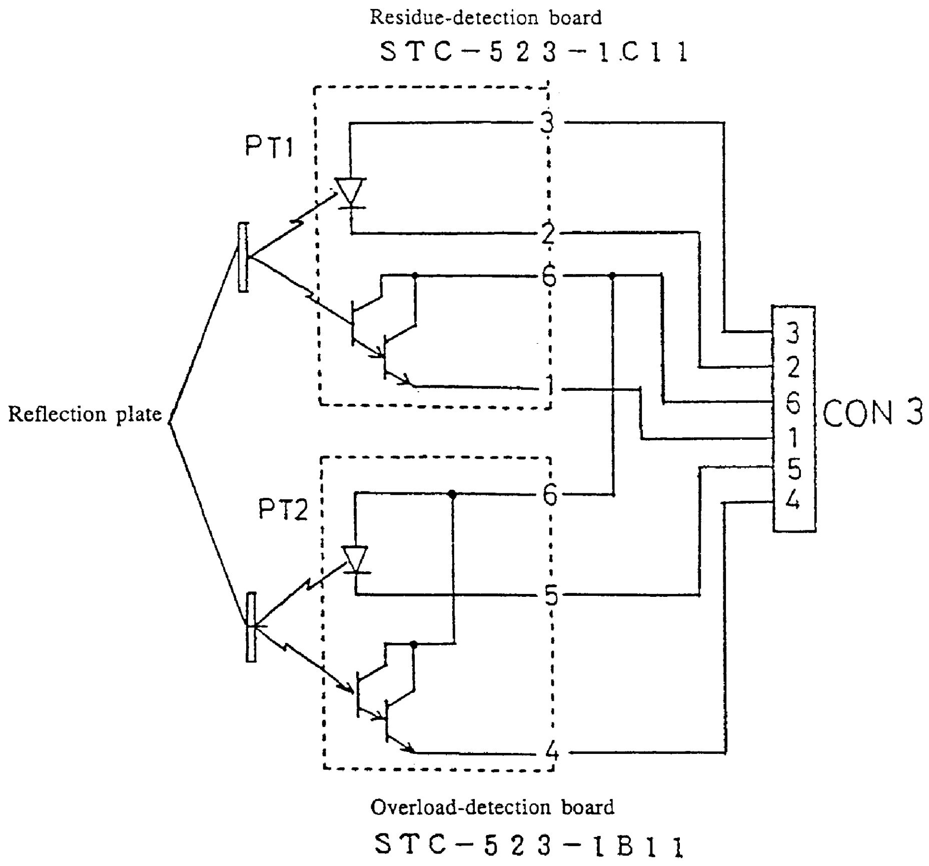
STC-523-1D11 board



Magnet
V1
R1
M1
R3
V1
R7
IC1
R4
R5
R6
R2
V1
R8
R14
IC1
M2
R10
V1
R12
R11
R13
R9
VT
1
4
3
2
CON2

Syringe	Magnetic eleme	
	M1	M2
None (L)	L	L
20	H	L
30	H	H
50	L	H
None (H)	L	L

8.7 Overload- and Residue-Detection Unit Circuit Diagram


Residue-detection board
STC-523-1C11
PT1
3
2
6
1
Reflection plate
PT2
6
5
4
3
2
6
1
5
4
CON 3
Overload-detection board
STC-523-1B11

9. PARTS LISTS AND EXPLODED DIAGRAMS

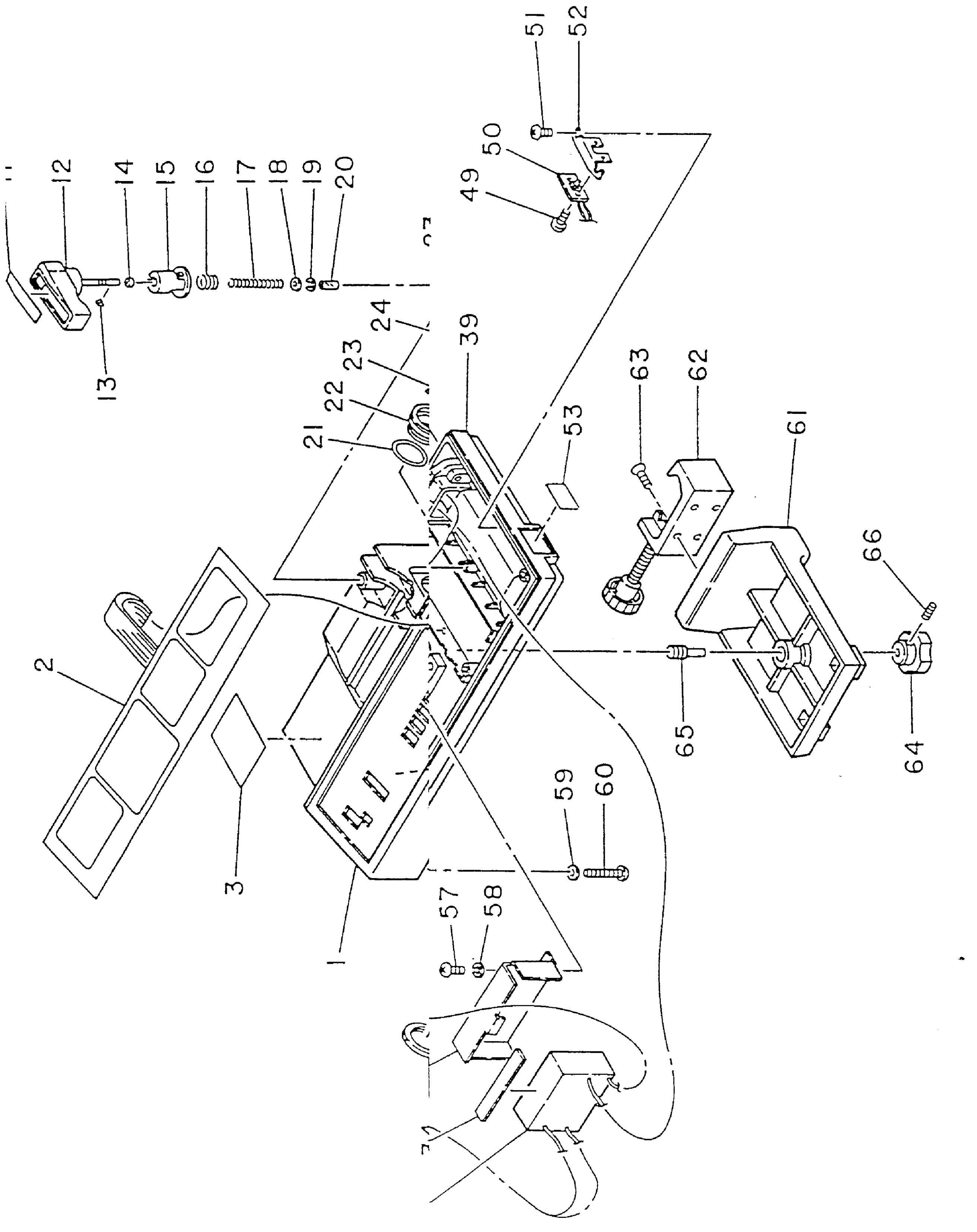
9.1 Main Unit

Part No.	Name	Model	Q'ty	Notes
1	Upper case	STC-523-2A01	1	
2	Panel keyboard	STC-523-1F01	1	
3	Caution label	STC-523-2G05	1	
4	Chassis assembly (drive unit)		1	
5	Pan-head screws	M4x10	4	
6	Buzzer	EFB-S46C04P	1	
7	Shield sheet	STC-523-2A08	1	
8	Control board	STC-523-1A11	1	
9	Flat washer	M2	3	
10	Tapping screws	M2x5	3	
11	Clamp label	STC-523-2G03	1	
12	Clamp	STC-523-2F01	1	
13	Magnet		1	
14	DU bush	DU0404	1	
15	Cap	STC-523-2F02	1	
16	Cap spring	STC-523-2F05	1	
17	Clamp spring	STC-523-2F03	1	
18	Collar	STC-523-2F04	1	
19	E-ring	nominal diameter 2. 5	1	
20	Shrink tube		1	
21	O-ring	S-16	1	
22	Boot joint	STC-523-2A02	1	
23	Boot stop ring	STC-523-2A05	1	
24	Boot	STC-523-2A04	1	
25	Slide pipe	STC-523-2E05	1	
26	Slider	STC-523-2E01	1	
27	Clutch box	STC-523-2E02	1	
28	O-ring	P4	1	
29	O-ring	P8	1	
30	Seal nut	STC-523-2E04	1	
31	Clutch shaft	STC-523-2E03-1	1	
32	Clutch	STC-523-2E03	1	
33	E-ring	Nominal diameter 3	1	
34	Pipe nut	M16	1	
35	Syringe detection board	STC-523-1D11	1	
36	Pan-head screws	M2X5	2	
37	Board retainer fittings	STC-523-2A06	1	
38	Tapping screw	M2x5	1	
39	Lower case	STC-523-2B01	1	
40	Tapping screws	M3x5	2	
41	Battery retainer	STC-523-2B09	1	
42	Battery	P-100ASx6	1	
43	Fuse	ES3 250V 500mA	1	
44	Tapping screw	M3x5	1	
45	Fuse holder	F-64AB	1	

[illegible]

Part No.	Name	Model	Q'ty	Notes
46	O-ring	S26	1	
47	AC inlet	SOT-16	1	
48	Truss screws (black)	M2.6x	2	
49	Pan-head screws	M3x5	2	
50	Power switch board	STC-523-1I11	1	
51	Tapping screws	M2.6x5	2	
52	Power switch bracket	STC-523-2B06	1	
53	Power switch sheet	STC-523-2G02	1	
54	Switching regulator	PB10SU-1200-A $ 152	1	
55	Cushion sheet		1	
56	Power supply bracket	STC-523-2B02	1	
57	Pan-head screws	M4x5	2	
58	Spring washers	M4	2	
59	Rubber packing	ø8xø4xt1	8	
60	Pan-head screws	M4x25	6	
		M4x15	2	
61	Tray	STC-521-2A46	1	
62	Ball clamp	STC-502-2C02A	1	
63	Plate screws	M4x12	4	
64	Knob	RP0203623	1	
65	Screw	STC502-2C02B	1	
66	Set-screw	M4x6	1	
67	Case sealing rubber	STC-523-2A03	1	

9.2 Exploded Diagram of Main Unit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9.3 Drive Unit

Part No.	Name	Model	Q'ty	Notes
1	Chassis	STC-523-2C01	1	
2	Feed screw	STC-523-2C03	1	
3	DU bush	DU0804	1	
4	DU bush	DU0404-9F	1	
5	Collar	STC-523-2F04	1	
6	Spur gear (3)	STC-523-2C06	1	
7	Set-screws	M3x4	2	
8	DU bushes	DU1015	2	
9	Encoders	STC-521-2A26	2	
10	Motor	26L18-216P-B24 1/128	1	
11	Spur gear (1)	STC-523-2C05	1	
12	Set-screws	M3x4	2	
13	Pan-head screws	M2x	3	
14	Spur gear (2)	STC-523-2C02	1	
15	E-ring	Nominal diameter 4	1	
16	Rotation-detection board	STC-523-1E11	1	
17	Tapping screws	M2x5	2	
18	Block	STC-523-2D01	1	
19	Silicon tube	ø xø5x3	1	
20	DU bushes	DU0508	2	
21	Guide shaft	STC-523-2C04	1	
22	E-ring	Nominal diameter 4	1	
23	Clutch spring	STC-523-2D05	1	
24	Clutch spring retainer plate	STC-523-2D07	1	
25	Stopper	ø3mm-diameter lug	1	
26	Pan-head screws	M3x4	1	
27	Pan-head screws	M3x4	1	
28	Fittings	STC-523-2D08	2	
29	Tapping screws	M2x5	2	
30	Pipe nut	M8	1	
31	Spring retainer plate	STC-523-2D02	1	
32	Overload springs	STC-523-2D04	4	
33	Feed nut	STC-523-2D03	1	
34	(half nut)	STC-523-2D03	1	
35	Allen screws	M3x10	2	
36	Set-screw	M3x6	1	
37	Limit board	STC-523-	1	
38	Tapping screws	M2x5	2	
39	Nuts	M2.3	2	
40	Residue-detection board	STC-523-1C11	1	
41	Tapping screws	M2x5	2	
42	Pan-head screws	M3x5	1	
43	Flexible cable		1	
44	Relay board	STC-523-1H11	1	
45	Overload-detection board	STC-523-1B11	1	

9.5 Parts Listings By Board

9.5.1 Control Board

Part No.	Name	Model and Standard	Q'ty	Notes
IC1	IC(CPU)	μPD8749HC	1	
IC2	IC(I/O)	μPD82C43P	1	
IC3	IC(HIC)	STC-503-1A32	1	
IC4, 5	IC(F. F)	HD14013BP	2	
IC6	IC(Comparator)	HA17339	1	
IC7	IC(Operation amp)	μPD1251C	1	
IC8	IC	TA78DL05P	1	
IC9, 10	IC	TD62501P	2	
IC11	IC	STA421A	1	
IC12	IC	HA14011	1	
Tr1	Transistor	2SC2655Y	1	
Tr2, 4~12	Transistor	2SC1815Y	10	
Tr3	Transistor	2SA1387	1	
Tr3Z1	Radiator	IC-1625-ST	1	
D1~4	LED	LA-301MB-1	4	
D5~7	LED	MU04-2101	3	
D8	LED	LT-9002H	1	
D9, 10	LED	LT-9002N	2	
D11~13	LED	GL-9HY4	3	
D14~16	LED	GL-9NG4	3	
D17, 22, 23, 25	Diode	1S2075K	4	
D18~20, 26, 27	Diode	W03A	5	
D21	Diode (Zenner)	HZ3B-2	1	
R1~9, 14~16, 18~21, 24, 25, 27, 29, 33, 34, 38, 39, 67, 12	Resistor (carbon)	ERD25VJ-103	26	
R10, 17, 30, 40, 47, 48, 59, 63, 66	Resistor (carbon)	ERD25VJ-104	9	
R11, 22	Resistor (carbon)	ERD25VJ-203	2	
R13, 61, 64, 68, 69, 80, 81	Resistor (carbon)	ERD25VJ-472	7	
R26	Resistor (carbon)	ERG1ANJ-220	1	
R28	Resistor (carbon)	ERD25VJ-471	1	
R31, 71~74	Resistor (carbon)	ERD25VJ-153	5	
R32	Resistor (carbon)	ERD25VJ-332	1	
R35	Resistor (carbon)	ERD25VJ-105	1	
R37, 41, 42	Resistor (carbon)	ERD25VJ-821	3	
R43	Resistor (metal-film)	ERO25CKF1332	1	
R44	Resistor (metal-film)	ERO25CKF4701	1	
R45	Resistor (metal-film)	ERO25CKF1002	1	
R46	Resistor (metal-film)	ERO25CKF1212	1	
R49~51	Resistor (carbon)	ERD25VJ-271	3	
R52~54	Resistor (carbon)	ERD25VJ-201	3	
R55~57	Resistor (carbon)	ERD25VJ-331	3	
R58	Resistor (carbon)	ERD25VJ-183	1	

Part No.	Name	Model and Standard	Q'ty	Notes
R60, 70	Resistor (carbon)	ERD25VJ-102	2	
R62, 65	Resistor (carbon)	ERD25VJ-411	2	
R75	Resistor (carbon)	ERD25VJ-560	1	
R76	Resistor (carbon)	ERD25VJ-272	1	
R77	Resistor (carbon)	ERD25VJ-3R9	1	
R82	Resistor (carbon)	ERD25VJ-511	1	Silk display TR13
RN1	Resistor network	EXB-C44-183J	1	
RN2	Resistor network	EXB-C44-431J	1	
RN3	Resistor network	EXB-R84-223J	1	
RN4, 5	Resistor network	EXB-C44-102J	2	
RN6	Resistor network	EXB-R87-103J	1	
RN7	Resistor network	EXB-R85-103J	1	
RN9	Resistor network	EXB-C47-431J	1	
VR1	Variable resistor	RH0621C 47KΩ	1	
VR2	Variable resistor	RH0621C 4.7KΩ	1	
VR3~8	Variable resistor	RH0621C 10KΩ	6	
C1, 2	Capacitor (ceramic)	ECC-F1H-220J	2	
C3, 5, 13, 16, 18~23	Capacitor (ceramic)	D55Y5V1H-104Z21	10	
C4, 14, 24	Capacitor (tantalum)	CS15E1E010M1S	3	
C6, 7	Capacitor (ceramic)	ECK-F1H-102KB	2	
C8~12	Capacitor (ceramic)	ECK-F1H-103ZF	5	
C15	Capacitor (ceramic)	D55Y5V1H-334Z21	1	
C17	Capacitor (chemical)	ECEA1ESS101	1	
L1	Coil	ELT-3K018K	1	
X1	Oscillator	HC-43/US (6MHz)	1	
CON1	Connector	PI011-07M5	1	
CON2	Connector	PI011-04M5	1	
CON3	Connector	PI011-06M5	1	
CON4, 5	Connectors	230-5-31-334	2	
CON6	Connector	PI011-03M5	1	
CON7	Connector	PI011-08M5	1	
CON8	Connector	PI021-03M5	1	
F1, 2	IC protector	ICP-F25	2	
TP1~18	Test pins	VTC-6-1	18	
PCB	Printed circuit board	STC-523-1A11	1	

9.5.2 Rotation-Detection Board

Part No.	Name	Model and Standard	Q'ty	Notes
PD1, 2	Photointerruptors	ON1110	2	
PCB1	Printed circuit board	STC-523-1E11	1	

9.5.3 Residue-Detection Board

Part No.	Name	Model and Standard	Q'ty	Notes
PT1	Photointerruptor	TLP907LB (O)	1	
PCB1	Printed circuit board	STC-523-1C11	1	

9.5.4 Relay Board

Part No.	Name	Model and Standard	Q'ty	Notes
PCB1	Printed circuit board	STC-523-1H11	1	

9.5.5 Overload-Detection Board

Part No.	Name	Model and Standard	Q'ty	Notes
PT1	Photosensor	TLP907LB (O)	1	
PCB1	Printed circuit board	STC-523-1B11	1	
FLK	Flexible cable		1	

9.5.6 Syringe-Detection Board

Part No.	Name	Model and Standard	Q'ty	Notes
IC1	IC (OP amp)	µPD1251G	1	
R1, 2, 8, 9	Resistors (carbon)	ERD-25VJ-201	4	
R3, 4, 10, 11	Resistors (carbon)	ERD-25VJ-102	4	
R5, 6, 12, 13	Resistors (carbon)	ERD-25VJ-105	4	
R7, 14	Resistors (carbon)	ERD-25VJ-514	2	
M1, 2	Hole element	SHS-260	2	
PCB1	Printed circuit board	STC-523-1D11	1	

10 REFERENCE DOCUMENTS

10.1 IC Pinouts (Table of Contents)

(1) µPD8749HC
(2) µPD82C43C
(3) TD62501P
(4) STA421A
(5) HA17339
(6) HD14013B
(7) HD14011B
(8) µPC1251

0.2 Detection Element Features

(1) TLP907LB (0)
(2) SHS260

μPD8749HC/D

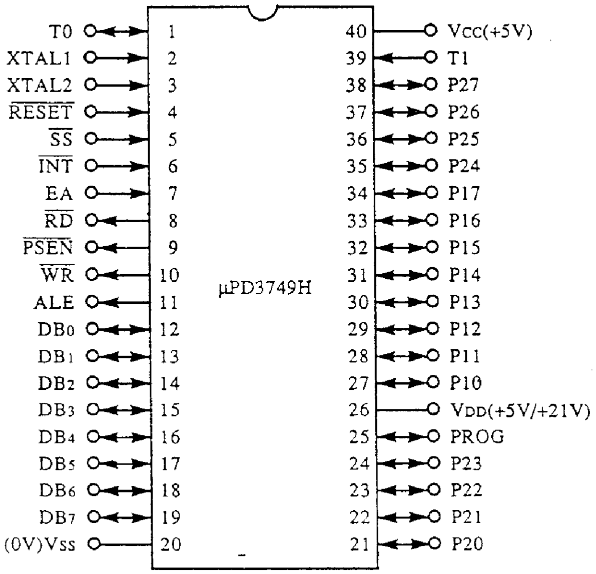
1-Chip 8-Bit Microprocessor

The μPD8749HC/D is an 8-bit microprocessor incorporating 8-bit parallel-processing ALU, PROM, RAM, IO ports and control circuit. Since programs can only be written once to the μPD8749HCs PROM, the μPD8749HC is suitable for small-volume production. In contrast, programs can be written multiple times to the PROM of the μPD8749HD, making this chip appropriate for systems development, etc. When switching to volume production, this chip can be replaced with the low-cost μPD8049H, which has internal masked ROM.

Features:

- 1-chip 8-bit microprocessor
- 96-instruction set
- 1.36μs/11HMz instruction cycle
- Operational functions:
  addition, logical operations, decimal correction
- 2K x 8-bit PROM
  Write once-only (μPD8749HC)
  UV-erasable, reprogrammable (μPD8749HD)
- 128 x 8-bit RAM
- 8-level stack
- Dual work registers
- Interrupt functions
- Two test inputs
- Internal timer/counter
- Expandable memory and IO ports
- IO ports
  Two 8-bit IO ports
  One 8-bit data bus (common use of IO ports)
- Single step function
- Internal clock oscillation circuit
- N-channel MOS
- Single-suppy (+5V)
- 40-pin plastic DIP
  μPD8749HC (P40C-100-600A)
- 40-pin ceramic windowed DIP
  μPD8749HD (P40DW-100-600A)

Connection Diagram (Top View)


T0
1
XTAL1
2
XTAL2
3
RESET
4
SS
5
INT
6
EA
7
RD
8
PSEN
9
WR
10
ALE
11
DB0
12
DB1
13
DB2
14
DB3
15
DB4
16
DB5
17
DB6
18
DB7
19
(0V)Vss
20
μPD3749H
40
Vcc(+5V)
39
T1
38
P27
37
P26
36
P25
35
P24
34
P17
33
P16
32
P15
31
P14
30
P13
29
P12
28
P11
27
P10
26
VDD(+5V/+21V)
25
PROG
24
P23
23
P22
22
P21
21
P20

Terminal Names

P10-P17 : IO port (PORT 1)
P20-P27 : IO port (PORT 2)
DB0-DB7 : Data bus (BUS)
T0,T1 : Test
$\overline{\text{INT}}$: Interrupt
$\overline{\text{RD}}$: Read
$\overline{\text{WR}}$: Write
ALE : Address latch enable
$\overline{\text{PSEN}}$: Program store enable
$\overline{\text{RESET}}$: Reset
$\overline{\text{SS}}$: Single step
EA : External access
PROG : Program pulse
XTAL 1, 2 : Crystal input

μPD82C43C/CY/D/G

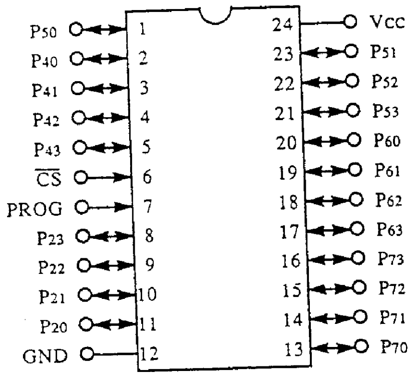
Expansion IO Ports

The μPD82C43 has been developed for extending the IO ports of the μPD80C48/49, and has four internal 4-bit ports. It is also possible to use multiple μPD82C43s in a system to further increase the number of available IO ports. μPD82C43 operation is controlled by the CPU program, the chip being capable of AND/OR output in addition to its normal IO functions.

Features:

- μPD80C48/49-compatible
- IO ports
  Four 4-bit IO ports
  One 4-bit IO port (for interfacing with the μPD80C48/49)
- AND/OR logic operation output
- Large output drive current
- Single-supply (+2.5-6V)
- 24-pin plastic DIP (μPD82C43C (P24C-100-600))
- 24-pin plastic slim DIP (μPD82C43CY (P24C-100-400A))
- 24-pin ceramic DIP (μPD82C43D (P24DH-100-600A2))
- 24-pin plastic mini-flat package (μPD82C43G (P24GM-50-450A))

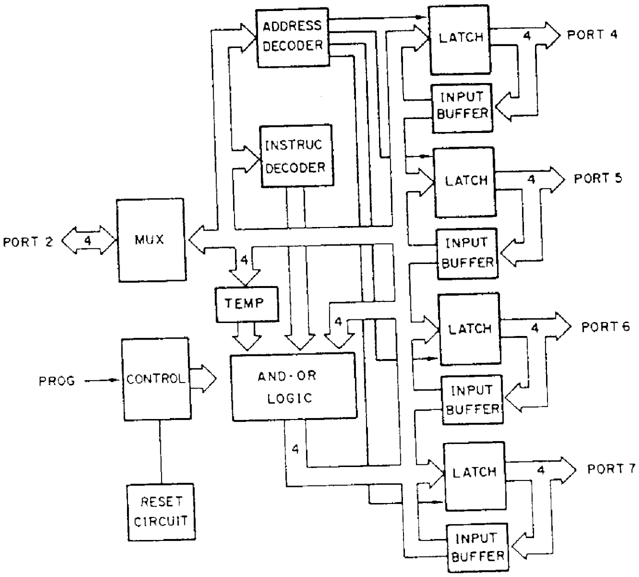
Connection Diagram (Top View)


P50 1
P40 2
P41 3
P42 4
P43 5
$\overline{CS}$ 6
PROG 7
P23 8
P22 9
P21 10
P20 11
GND 12
24 Vcc
23 P51
22 P52
21 P53
20 P60
19 P61
18 P62
17 P63
16 P73
15 P72
14 P71
13 P70

Terminal Names:

P20~P22 : Input Output port Port 2
P40~P43 : Input Output port Port 4
P50~P53 : Input Output port Port 5
P60~P63 : Input Output port Port 6
P70~P73 : Input Output port Port 7
$\overline{CS}$: Chip Select
PROG : Program pulse

Block Diagram


ADDRESS DECODER
INSTRUC DECODER
LATCH
INPUT BUFFER
PORT 4
PORT 5
PORT 6
PORT 7
4
PORT 2
MUX
TEMP
AND-OR LOGIC
PROG
CONTROL
RESET CIRCUIT

TD62501P, TD62502P, TD62503P, TD62504P, TD62505P, TD62506P, TD62507P

SINGLE DRIVER

TD62501P	COMMON	EMITTER
TD62502P	COMMON	EMITTER
TD62503P	COMMON	EMITTER
TD62504P	COMMON	EMITTER
TD62505P	COMMON	COLLECTOR
TD62506P	COMMON	COLLECTOR
TD62507P	ISOLATED	

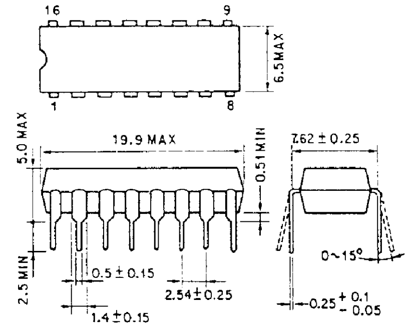
Outline

The chips in the TD62501P Series are NPN transistor arrays featuring 7 circuits or 5 circuits.
The chips in this series feature internal input resistors limiting the base current and Zenner diodes for level hifting allowing ready connection of TTL, ?? MOS and P-MOS and their ability to be used with minimal parts being attached. If using arrays with no input resistance, a suitable resistance should be incorporated in the circuit. Also, the SUB terminal must be connected to the lowest potential in the circuit.

Features:

- Standard 16-pin DIP with 7 or 5 circuits
- Built-in input resistance
  - TD62503P, TD62506P $R_{IN}=27k\Omega$
  - TD62504P $R_{IN}=10.5k\Omega$
- Built-in level-shift Zenner diode and input resistance
  - TD62502P $V_Z=7V$, $R_{IN}=10.5k\Omega$

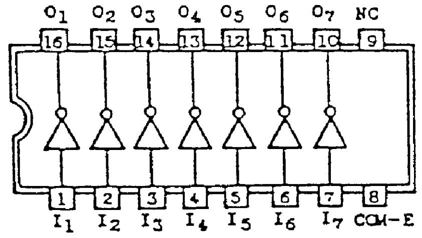
Unit: mm


16
9
1
8
6.5MAX
5.0MAX
19.9 MAX
0.51MIN
7.62±0.25
2.5MIN
0.5±0.15
2.54±0.25
1.4±0.15
0~15°
0.25+0.1 −0.05

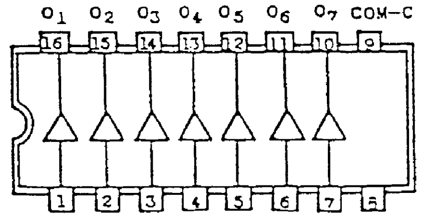
JEDEC	
Toshiba	3D16A-P

Pinout diagram

TD62501P, TD62502P, TD62503P, TD62504P


O1
O2
O3
O4
O5
O6
O7
NC
16
15
14
13
12
11
10
9
1
2
3
4
5
6
7
8
I1
I2
I3
I4
I5
I6
I7
COM-E

TD62505P, TD62506P


O1
O2
O3
O4
O5
O6
O7
COM-C
16
15
14
13
12
11
10
9
1
2
3
4
5
6
7
8

Maximum Ratings (Ta=25°C)

Item	Symbol	Rating	Unit
Withstand voltage between collector/emitter	V_{CEO}	35	V
Withstand voltage between collector/base	V_{CBO}	50	V
Collector current	I_C	200	mA
Input voltage	V_{IN}(note 1)	-0.5~+4.5	V
Input voltage	V_{IN}(note 2)	-0.5~+3.0	V
Input current	V_{IN}(note 3)	25	mA
Separation withstand voltage	V_{SUB}	35	V
GND terminal current	I_{GND}	500	mA
Permissible loss	P_D	1.0	W
Operating temperature	T_{opr}	-40~+85	°C
Storage temperature	T_{stg}	-55~+150	°C

Note 1: TD62506P
Note 2: TD62502P, TD62503P, TD62504P
Note 3: TD62501P, TD62505P, TD62507P

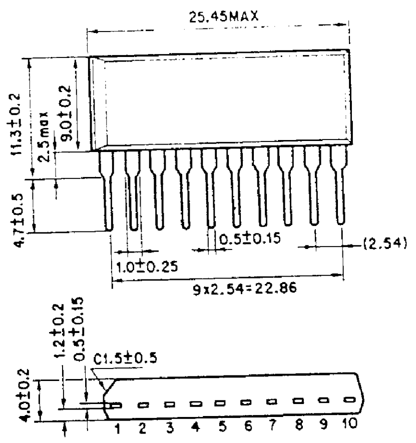
When Using

External Appearance and Pinout (unit: mm)

Symbols: E, emitter; B, base; C, collector

STA400A Series

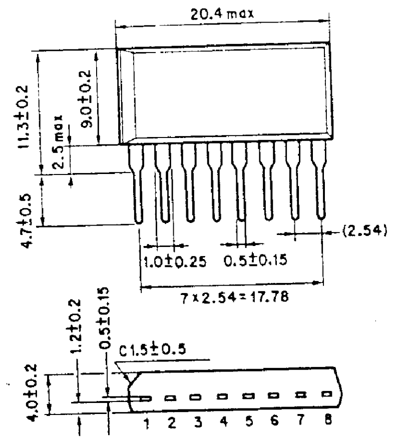
Product weight: 2.6g


25.45MAX
11.3±0.2
2.5max
9.0±0.2
4.7±0.5
0.5±0.15
(2.54)
1.0±0.25
9x2.54=22.86
1.2±0.2
0.5±0.15
C1.5±0.5
4.0±0.2
1 2 3 4 5 6 7 8 9 10

Pinout	1	2	3	4	5	6	7	8	9	10
	E	B	C	B	C	B	C	B	C	E

STA300A Series

Product weight: 2.0g


20.4 max
11.3±0.2
2.5max
9.0±0.2
4.7±0.5
(2.54)
1.0±0.25
0.5±0.15
7x2.54=17.78
1.2±0.2
0.5±0.15
C1.5±0.5
4.0±0.2
1 2 3 4 5 6 7 8

Pinout	1	2	3	4	5	6	7	8
	E	B	C	B	C	B	C	E

STA400C Series

Product weight: 2.6g

External appearance same as above; pinout shown below

Pinout

A: Diode anode
K: Diode cathode
N: Not connected

Name	1	2	3	4	5	6	7	8	9	10
STA441C	E	C	B	K	A	A	K	E	C	B
STA451C	E	C	B	E	B	B	E	B	C	E
STA453C	E	C	B	E	B	E	B	E	C	B

μPC177/339

Quad Comparator

The PC177/339 are high-performance quad (4-channel) comparators operating within the wide single-supply voltage range of 2V to 36V. The single-chip 14-pin dual-in-line package houses four comparator circuits that are almost wholly equivalent to existing general-purpose operation amps in terms of input characteristics, making this quad comparator ideal for application in circuits requiring the parallel comparison of multiple signals and where a high mounting density is required. The μPC177 is suitable for communications, the μPC339 for general purposes.

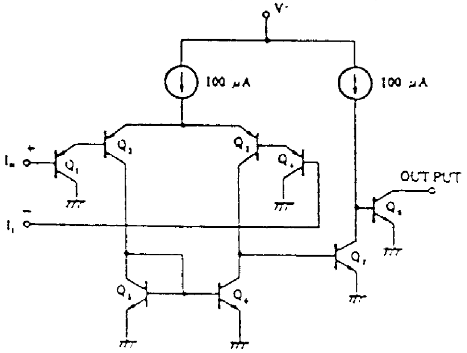
General Features:

- Input offset voltage: 2mV
- Input bias current: 25nA
- Voltage gain: 200 V/mV
- Response time 1.3 μs
- Output adsorption current: 16mA
- Operating temperature:
  - -20~+80°C: 177ED, 177D
  - -40~+85°C: 177C, 177G
  - -20~+80°C: 339C, 339G
- Storage temperature:
  - -55~+150°C: 177ED, 177D
  - -55~+125°C: 177C, 177G
  - 339C, 339G

Ordering Information

Order Name	Package
μPC177ED	14-pin ceramic DIP (300-mil)
μPC177D	14-pin ceramic DIP (300-mil)
μPC177C	14-pin plastic DIP (300-mil)
μPC177G2	14-pin plastic SOP (225-mil)
μPC339C	14-pin plastic DIP (300-mil)
μPC339G2	14-pin plastic SOP (225-mil)

Equivalence Circuit (1/4 circuit)



Note: The μPC177D is designed for NTT's special communications tasks. The μPC177ED is designed for general purpose communications.

Other Features:

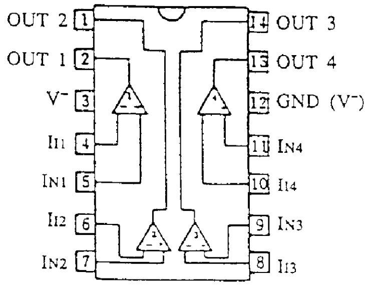
- Wide range of power supplies:
  - 2V - 36V single-supply
  - ±1V - ±18V plus/minus supply
- Low circuit consumption: 0.8mA
- Wide phase input voltage range:
  - 0V~V⁺–1.5V(single-supply)
- Wired OR possible at open collector output

Appearance Diagrams:

μPD177ED, 177D	TYPE 31
μPC177C, 339C	TYPE 10
μPC177G, 339G	TYPE 24

Connection Diagram (Top View)

μPC177ED, 177D, 177C, 177G/339C, 339G



HD14013B

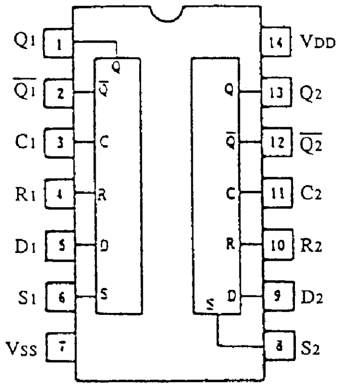
Dual D-type Flip Flop

The HD14013B is a dual D-type flip flop, each flip flop having independent Data, Set, Reset and Clock inputs and complementary outputs Q and xto(Q). The HD14013B can be used for shift registers or as T-type flip flops for counters and toggles.

Features:

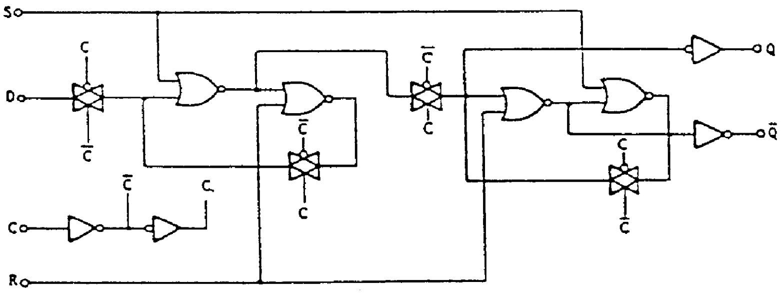
- Static operation
- Low power consumption of 2.0nA typ/package (VDD=5V)
- Operating power supply of 3.0 to 18V
- Toggle frequency of 4MHz type (VDD=5V)
- Logic state can be maintained HIGH or LOW by clock level
- Compatible with RCA CD4013B and Motorola

Pinout


Q1
1
Q
$\overline{Q1}$
2
$\overline{Q}$
C1
3
C
R1
4
R
D1
5
D
S1
6
S
Vss
7
VDD
14
Q2
13
Q
$\overline{Q2}$
12
$\overline{Q}$
C2
11
C
R2
10
R
D2
9
D
S
S2
8

(Top View)

Block Diagram (1/2)


S
D
C
R
C
$\overline{C}$
$\overline{C}$
C
$\overline{C}$
C
$\overline{C}$
C
C
$\overline{C}$
Q
$\overline{Q}$

Truth Table

Input				Output	
Clock*	Data	Reset	Set	Q	$\overline{Q}$
↑	0	0	0	0	1
↑	1	0	0	1	0
↓	x	0	0	Q	$\overline{Q}$
x	x	1	0	0	1
x	x	0	1	1	0
x	x	1	1	1	1

*: Level change

x: Either 1 or 0

HD14011B

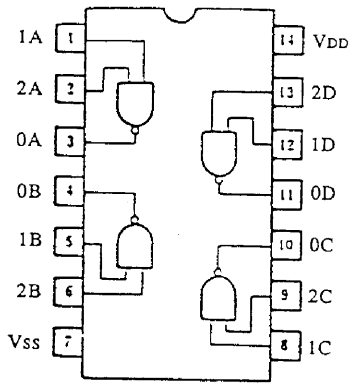
Quadruple 2-input NAND Gate

The HD14011B is a 2-input NAND gate suitable for fields where a high level of noise tolerance and low power consumption are required.

Features:

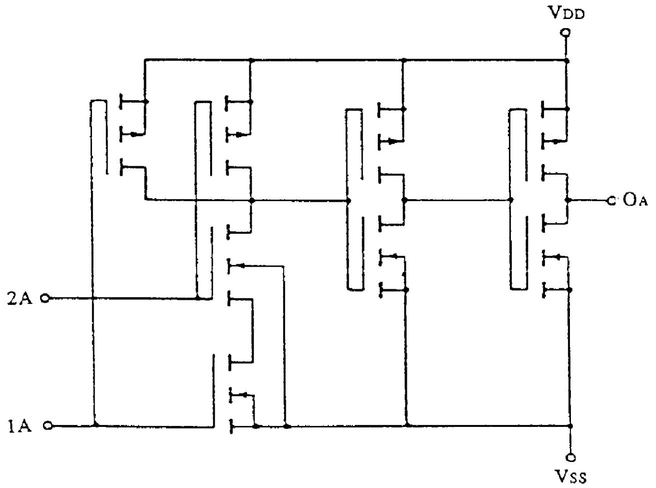
- Low power consumption of 0.5nA typ/package (V_{DD}=5V)
- High level noise tolerance of V_{DD} 45% typ
- Output drive capability: ability to drive one low power Schottky TTL (74LS Series)
- Compatible with RCA CD4011B and Motorola MC14011B

Pinout

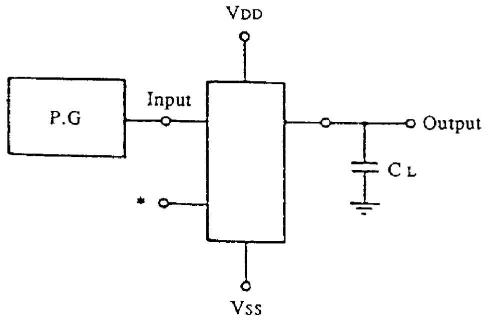

1A 1
2A 2
0A 3
0B 4
1B 5
2B 6
Vss 7
1C 8
2C 9
0C 10
0D 11
1D 12
2D 13
VDD 14

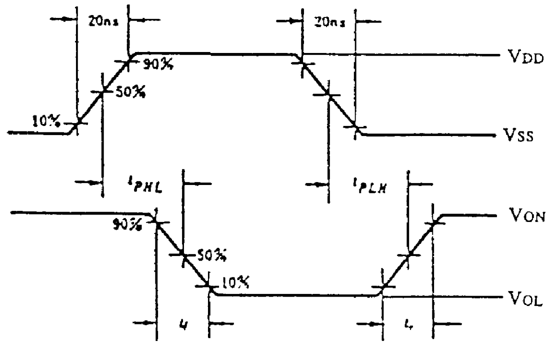
(Top View)

Circuit Structure (1/4)


VDD
OA
2A
1A
VSS

Switching Time Measurement Circuit


VDD
P.G
Input
Output
*
C L
VSS


20ns
20ns
90%
50%
10%
VDD
VSS
tPHL
tPLH
90%
50%
10%
VON
VOL
tf
tr

Note: Connect all inputs which are not used other than those used for measurements to V_{DD}.

μPC1251/358

High-performance Dual Operational Amplifier Circuit

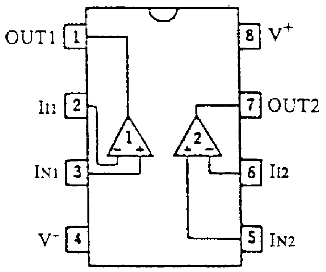
The μPC1251/358, which incorporates a built-in phase-correction circuit, is a single package IC housing two high-performance operational amplifiers which can operate on single-supplies ranging from 3V to 30V. As with existing general-purpose amplifiers, the μPC1251/358 can operate using plus/minus power supplies, is almost identical to the μPC151/741 in electrical characteristics, and because of its low power consumption, enables increased PCB densities and can be expected to greatly improve device reliability. The μPC1251 is designed for communications tasks, while the μPC358 is intended for general-purpose use.

Features:

- Input offset voltage: ±2 mV(TYP.)
- Input offset current: ±5 nA(TYP.)
- Large-amplitude voltage gain:
  100 000(TYP.)
- Operating temperature:
  - -20~+80°C: 1251D
  - -40~+85°C: 1251C, 1251G
  - -20~+80°C: 358C, 358G, 358HA
- Storage temperature:
  - -55~+150°C: 1251D
  - -55~+125°C: 1251C, 1251G
    358C, 358G, 358HA
- No phase correction required
- Output voltage range for 0 to V+-1.5V
- Input voltage range extends almost to GND level
- Wide operating power supply voltage
  3V ~ 30V (single-supply)
  ±1.5V~±15V (dual-supply)

Pinout (Top View)

μPC1251D, 1251C, 1251G
μPC358C, 358G



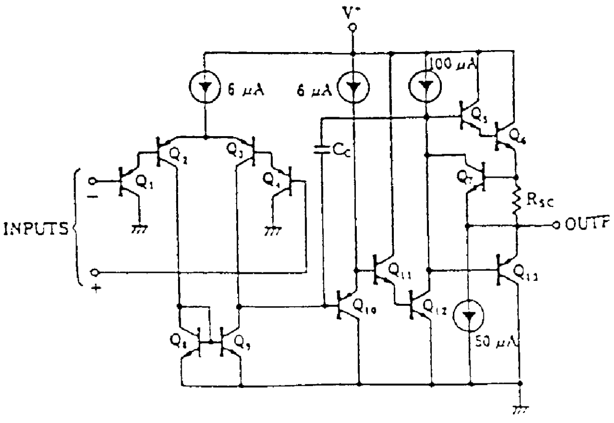
Ordering Information

Orde Name	Package
μPC1251D	8-pin ceramic DIP (300-mil)
μPC1251C	8-pin plastic DIP (300-mil)
μPC1251G2	8-pin plastic SOP (225-mil)
μPC358C	8-pin plastic DIP (300-mil)
μPC358G2	8-pin plastic SOP (225-mil)
μPC358HA	8-pin plastic slim SIP

Appearance Diagrams:

μPC1251D	TYPE30
μPC1251C/358C	TYPE9
μPC1251G/358G	TYPE23
μPC358HA	TYPE7

Equivalence Circuit (1/2 circuit)



SHS260

GaAs Hole Element

Applications:

- Brushless motors, contactless switches, rotation of magnetic bodies and positional detection.
- Various magnetic detection

Features:

- Low temperature coefficient hole output voltage
- Excellent hole output voltage magnetic field linearity
- Excellent hole output voltage control current linearity
- Ultra-small package for smaller and flatter sets

Absolute Maximum Ratings /Ta=25°C

			unit
Maximum control current	I_C, max	10	mA
Maximum control voltage	V_C, max	7	V
Permissible loss	P_D	150	mW
Operating temperature	T_{opg}	-55~+125	°C
Storage temperature	T_{stg}	-55~+150	°C

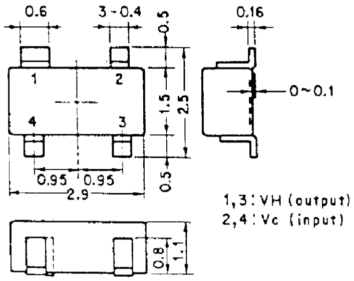
Electrical Characteristics Ta=25°C

			min	typ	max	unit
Hole output voltage	V_h	IC=5mA, B=1kG	60		105	mV
Unbalanced ratio	V_o/V_h	IC=5mA, B=0/1kG			±10	%
Input resistance	r_i	I=1mA	450		900	Ω
Output resistance	r_o	I=1mA	850		1700	Ω
Hole output voltage temperature coefficient					-0.06	%/°C
Input/Output resistance temperature coefficient					0.3	%/°C

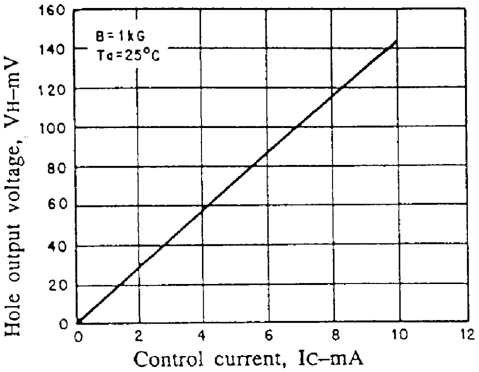
Notes:

Vh=Vhm-Vo Vhm:Measured hole output voltage
Vo:unbalanced voltage

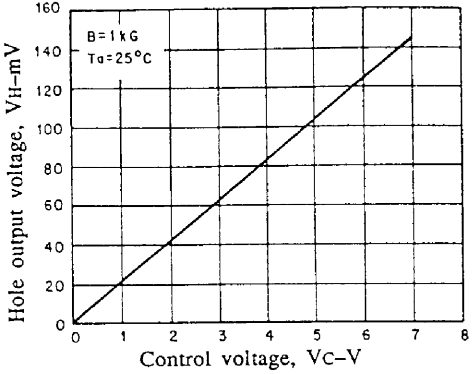
Appearance Diagram



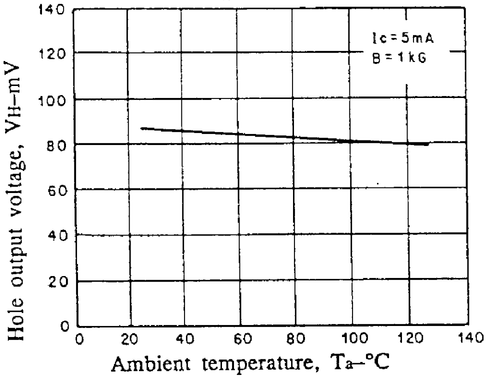
VH - Ic



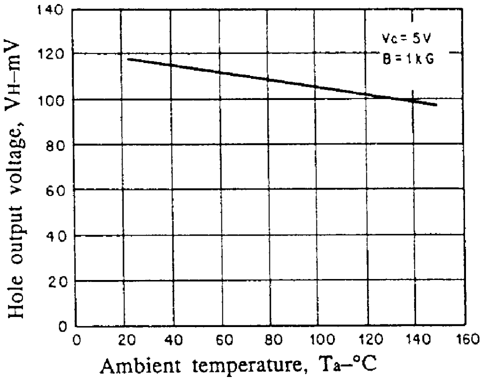
VH -Vc



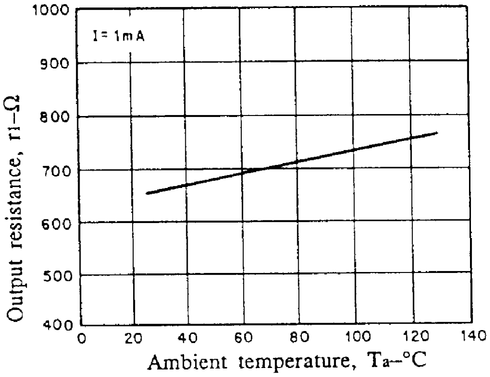
VH - Ta



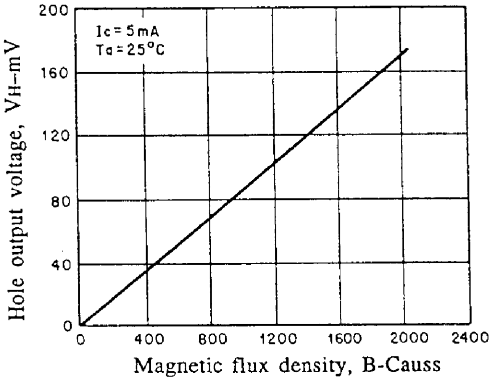
VH - Ta



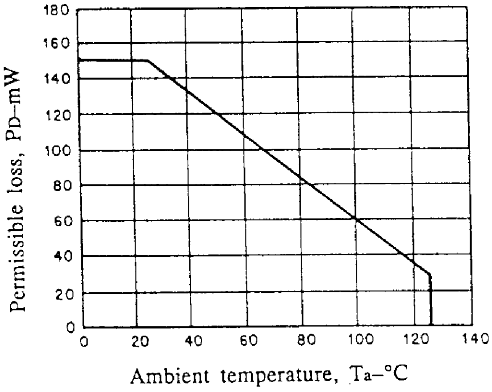
ri - Ta



VH - B



PD - Ta

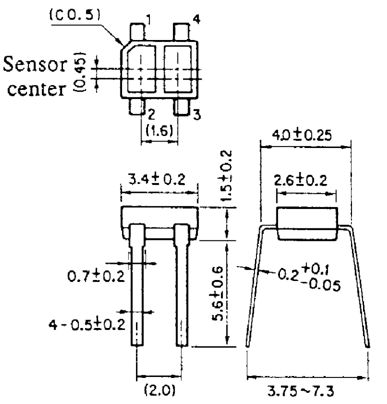


TLP907(LB)

Reflective Photosensor
Infrared LED + Photo-Darlington Transistor

- Start and end-mark detection in VTRs and audio tape
- VTR reel rotation detection
- Micro-floppy disk drive index, write-protect and disk-in detection
- Electronic printer and typewriter timing detection
- Reading of camera film information (DX code)
- Ultra small: 2.6 x 3.4mm (height 15mm)
- DIP package allowing simply mounting on PCBs
- Short detection distance: minimum distance: 0.5 to 1.5mm
- Visible-ray-cut type for low influence from external disturbance (fluorescence, etc.)
- High sensitivity: Ic=3mA (standard)

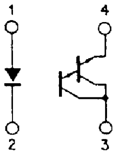
Unit: mm



( ) indicate reference values

JEDEC	–
EIAJ	–
Toshiba	11-4B101

Pinout



1	Anode
2	Cathode
3	Collector
4	Emitter

Maximum Ratings (Ta=25°C)

Item	Symbol	Rating	Unit
Light-emitter			
DC forward current	I_F	50	mA
Pulse forward current (note 1)	I_{FP}	400	mA
DC reverse voltage	V_R	5	V
Light-receiver			
Voltage between collector-emitter	V_{CEO}	30	V
Voltage between emitter-collector	V_{ECO}	5	V
Collector loss	P_C	50	mW
Collector current	I_C	20	mA
Operating temperature	T_{opr}	-25~85	°C
Storage temperature	T_{stg}	-30~100	°C

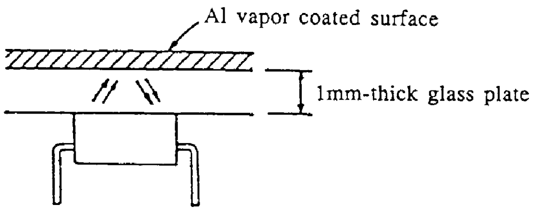
Note 1: Pulse width≤100µs, repetition frequency=100Hz

Electrical Characteristics (Ta=25°C)

Item	Symbol	Measuring Conditions	Min	Standard	Max	Unit
Light-emission						
Forward voltage	V_F	I_F=10mA	1.00	1.15	1.30	V
Reverse current	I_R	V_R=5V	-	-	10	µA
Inter-terminal capacity	C_T	V=0, f=1MHz	-	30	-	pF
Light reception						
Forward current	$I_D(I_{CEO})$	V_{CE}=16V, I_F=0	-	-	0.25	µA
Inter-terminal capacity	C_T	V=0, f=1MHz	-	7	-	pF
Transfer characteristics						
Collector current	I_C	V_{CE}=2V, I_F=4mA (Note 3)	0.5	3	15	mA
Leakage current	I_{LEAK}	V_{CE}=2V, I_F=4mA, No reflector	-	-	0.25	µA
Saturation voltage between collector-emitter	$V_{CE(sat)}$	I_F=4mA, I_C=0.25mA	-	0.85	1.2	V
Rise time	t_r	V_{CC}=5V, I_C=10mA	-	100	-	µs
Fall time	t_f	R_L=100Ω	-	100	-	µs

Note 2: Ic classification: R: 0.5~1.9mA, O: 1.45~5.4mA, Y: 4.5~15mA

Note 3: Method of measuring collector current:



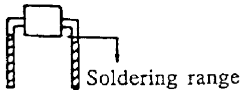
Usage Cautions

- Soldering temperature ≤ 260°C, soldering time ≤ 3 seconds (portions under the lower face of th plastic part)
- When forming leads, do so below the bend and take care not to apply forming stress to the plasti part.

  Carry out forming before soldering.
- When using chemicals such as flux, etc., for cleaning, observe the following conditions:

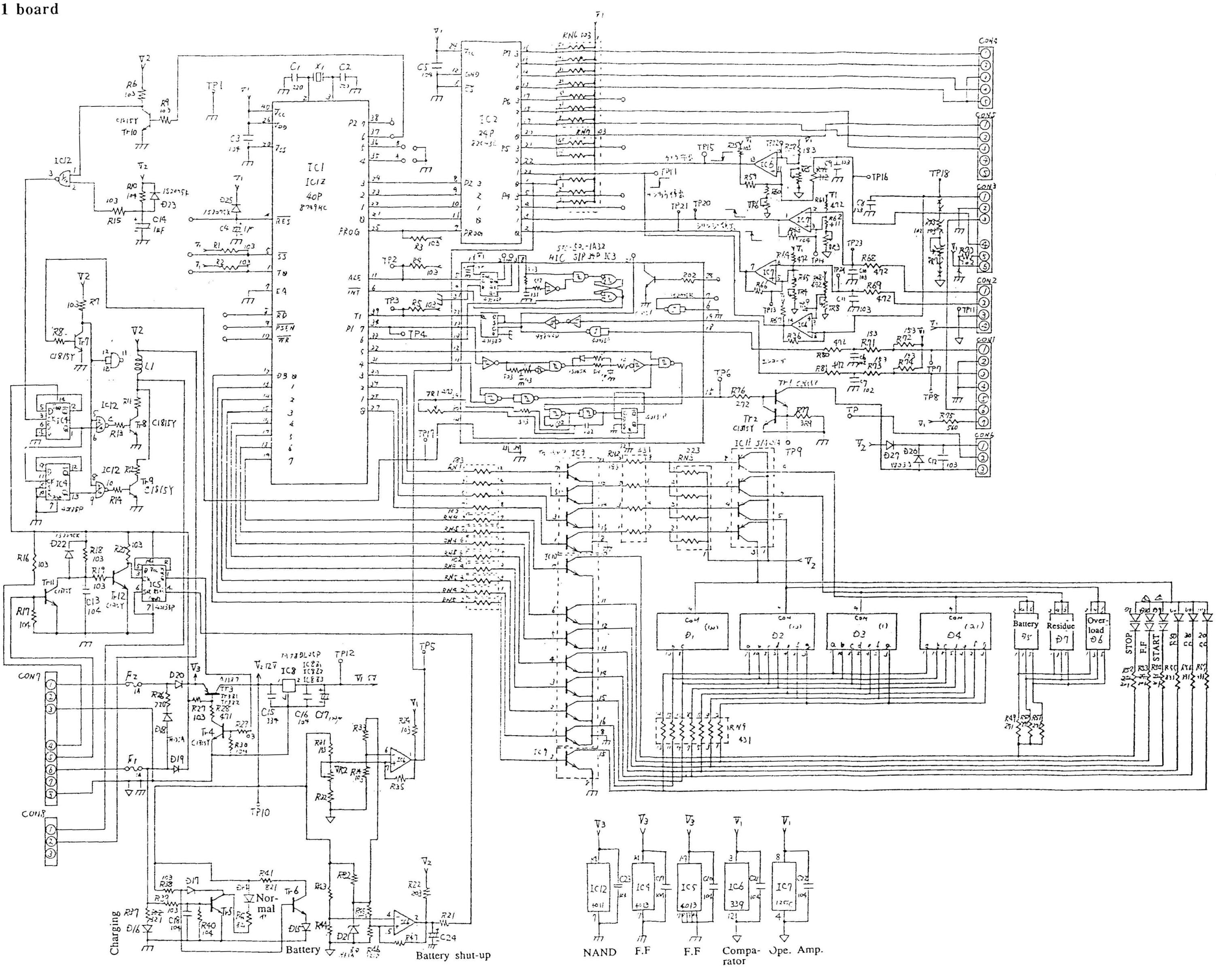
  Acceptable chemicals: Freon TE or TF, Difron (di-fluorocarbon) solvent S3 or S3-E

  Temperature and time: Temperature of chemical to be 45°C or less, and cleaning time to b within 30 seconds.

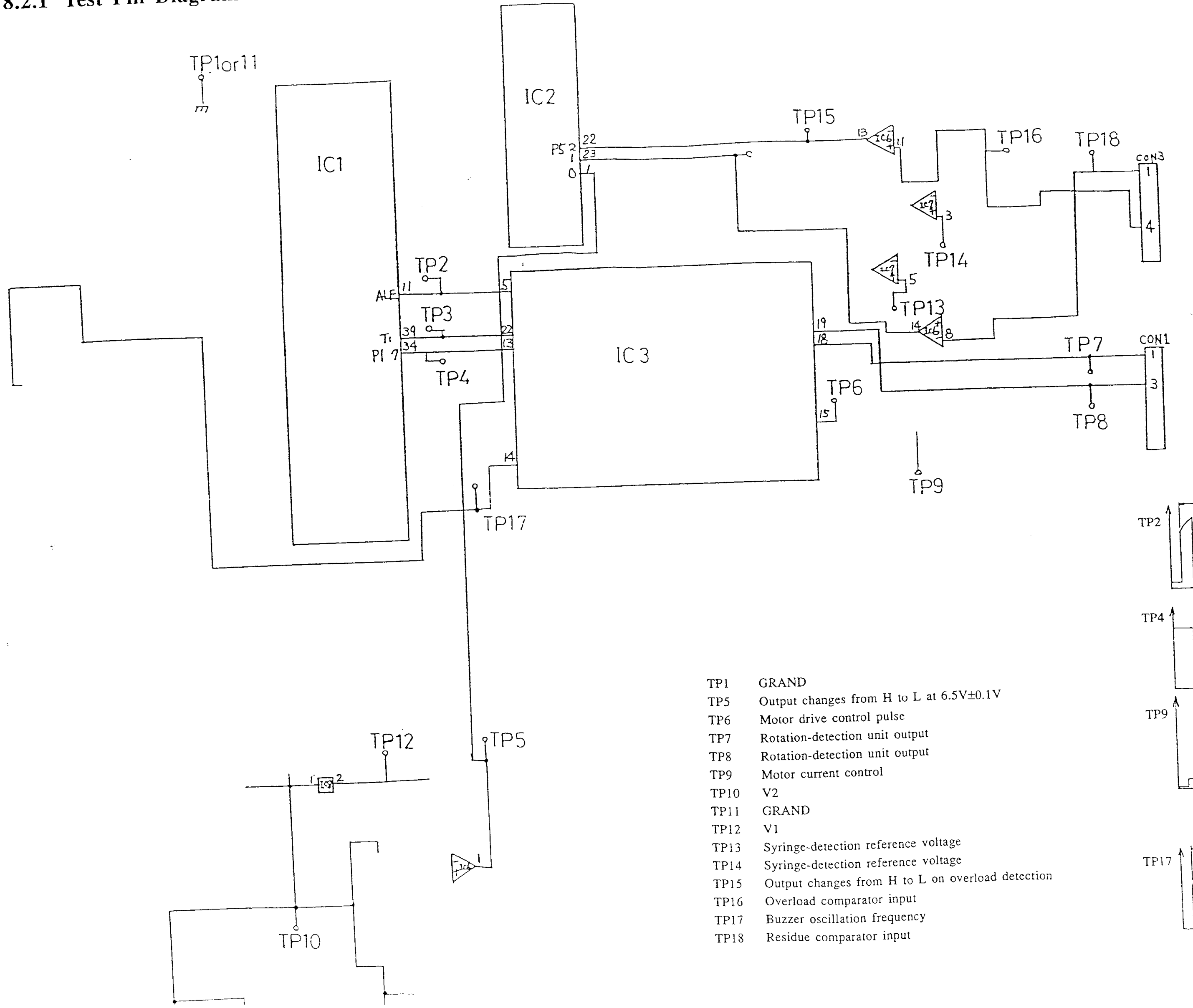


8.2 Control Unit Circuit Diagram

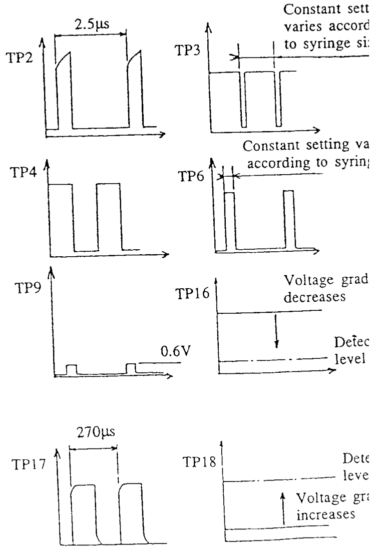
STC-523-1A11 board


IC1
IC1Z
40P
8749HC
IC2
24P
X1
C1
C2
C3
C4
C5
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
TP11
TP12
TP15
TP16
TP17
TP18
TP20
TP21
TP23
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
IC11
IC12
Tr1
Tr2
Tr3
Tr4
Tr5
Tr6
Tr7
Tr8
Tr9
Tr10
Tr11
Tr12
C1815Y
L1
F1
F2
D1
D2
D3
D4
D5
D6
D7
CON1
CON2
CON3
CON4
CON5
CON6
CON7
CON8
Battery
Residue
Over-load
STOP
F.F
START
Charging
Normal
Battery
Battery shut-up
IC12
4011
IC9
4013
IC5
4013
IC6
339
IC7
NAND
F.F
F.F
Compa-rator
Ope. Amp.

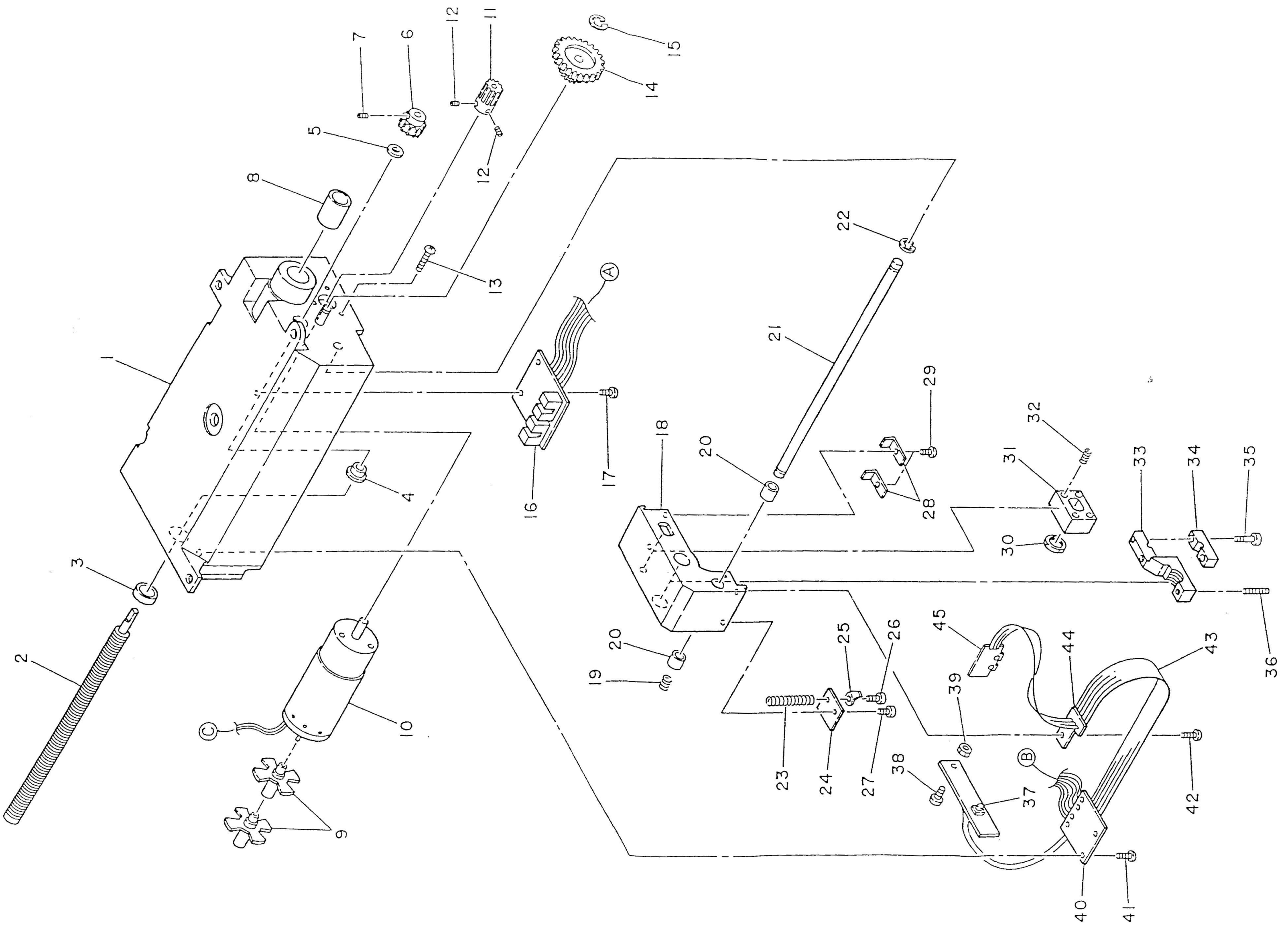
8.2.1 Test Pin Diagram


TP1or11
IC1
IC2
IC3
ALE
11
T1
39
P1 7
34
TP2
TP3
TP4
5
22
13
14
P5 2
1
0
22
23
1
TP15
13
IC6
11
TP16
TP18
CON3
1
4
IC7
3
TP14
IC7
5
TP13
14
IC6
8
19
18
TP7
CON1
1
3
TP6
15
TP8
TP9
TP17
TP5
TP12
1
IC9
2
IC4
1
TP10

TP1	GRAND
TP5	Output changes from H to L at 6.5V±0.1V
TP6	Motor drive control pulse
TP7	Rotation-detection unit output
TP8	Rotation-detection unit output
TP9	Motor current control
TP10	V2
TP11	GRAND
TP12	V1
TP13	Syringe-detection reference voltage
TP14	Syringe-detection reference voltage
TP15	Output changes from H to L on overload detection
TP16	Overload comparator input
TP17	Buzzer oscillation frequency
TP18	Residue comparator input


TP2
2.5μs
TP3
Constant sett
varies accord
to syringe si
TP4
TP6
Constant setting va
according to syrin
TP9
0.6V
TP16
Voltage grad
decreases
Detec
level
TP17
270μs
TP18
Dete
leve
Voltage gra
increases

9.4 Exploded Diagram of Drive Unit



1
2
3
4
5
6
7
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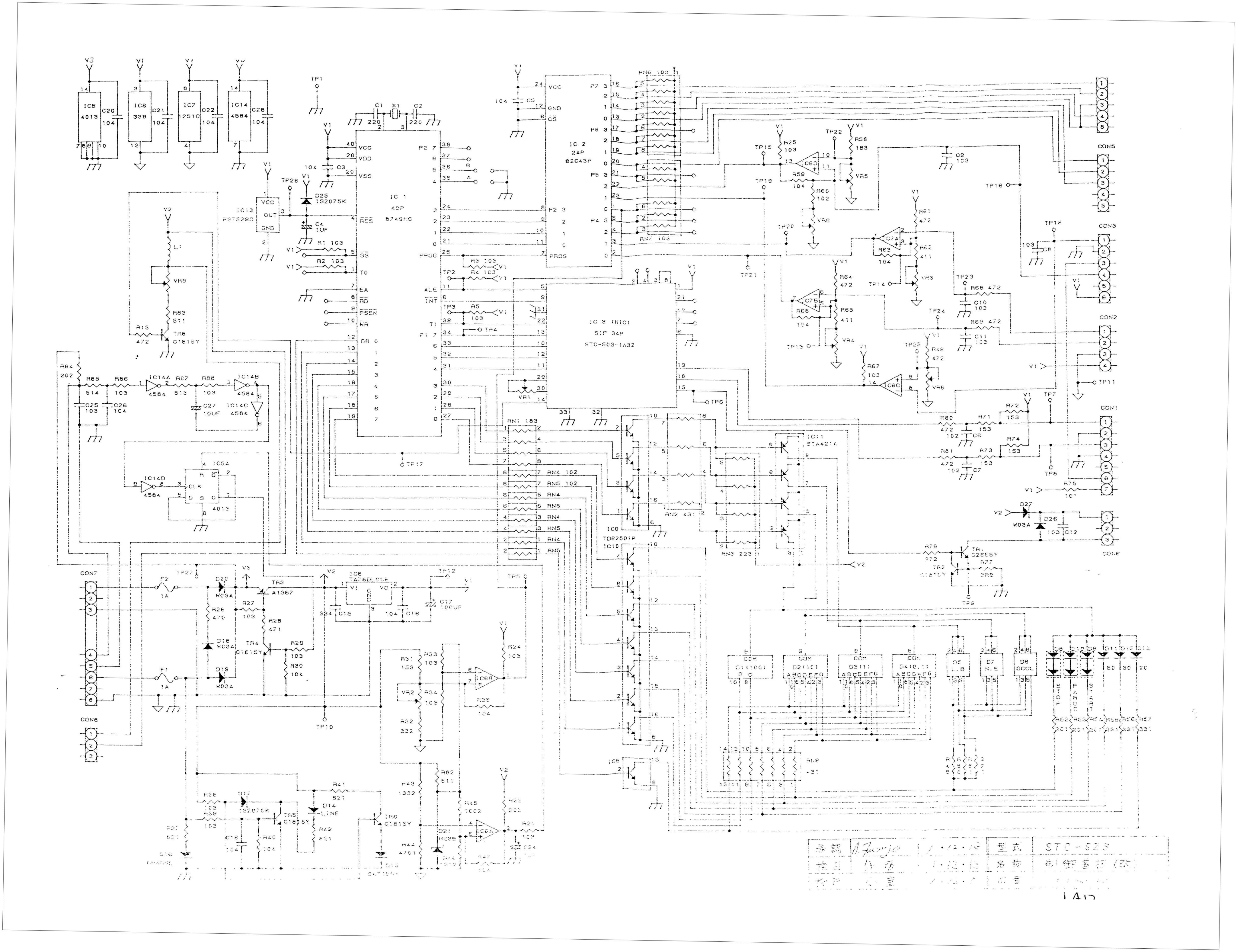
38
39
40
41
42
43
44
45
A
B
C


IC5 4013
IC6 339
IC7 1251C
IC14 4584
IC13 PST529D
IC 1 40P 8749HC
IC 2 24P 82C43P
IC 3 (HIC) SIP 34P STC-503-1A32
IC5A 4013
IC14A 4584
IC14B 4584
IC14C 4584
IC14D 4584
IC8 TA78DL05P
IC6A
IC6B
IC6C
IC6D
IC7A
IC7B
IC9 TD62501P
IC10
IC11 STA421A
RN1 183
RN2 431
RN3 223
RN4 102
RN5 102
RN6 103
RN7 103
RN8 431
X1
TR1 C2655Y
TR2 C1815Y
TR3 A1367
TR4 C1815Y
TR5 C1815Y
TR6 C1815Y
D1 (100)
D2 (10)
D3 (1)
D4 (0.1)
D5 L.B
D7 N.E
D6 OCCL
D8 STOP
D10 PAUSE
D9 START
D11 50
D12 30
D13 20
D14 LINE
D15 BATTERY
D16 CHARGE
D17 1S2075K
D25 1S2075K
D27 W03A
D26 W03A
D20 W03A
D18 W03A
D19 W03A
D21 RD2B
F1 1A
F2 1A
L1
CON1
CON2
CON3
CON5
CON6
CON7
CON8
V1
V2
V3

承認	A Furujo	1・12・18	型式	STC-523
検図	[illegible]	1・12・12	名称	制御基板(改)
設計	[illegible]	1・12・[illegible]	図番	[illegible]

1A12